ENGINEERING AND
BOILER HOUSE REVIEW

ESTABLISHED 1899

TWO SHILLINGS & SIXPENCE

VOL. 74 NO. 11 • THE PIONEER STEAM JOURNAL • NOVEMBER, 1959

FULLY AUTOMATIC OIL HEATING NOW ALSO IN SMALL INSTALLATIONS WITH

Danfoss

Danfoss

LOW PRESSURE PUMP TYPE LP

Specially designed for small oil burners, the LP type pump is a small, compact unit consisting of an oil pump, an air pump for the atomising air, an automatic oil valve, and a strainer.

The pump ensures good heating economy, even in boilers with only 11 sq. ft. of heating surface.

Type LP is designed for oil of a max. viscosity of 48 sec. R1 at 100° F. and, using the same nozzle and the same nozzle valve, it may be adjusted during working cycles to any capacity between 0.2 and 2 Imp. gallons of oil per hour.

Adjustment of oil volume and air pressure is quite simply effected from the outside with the aid of a special key.

Easy change-over from 1-pipe to 2-pipe system.

Pipe lines may be connected from left or right as desired.

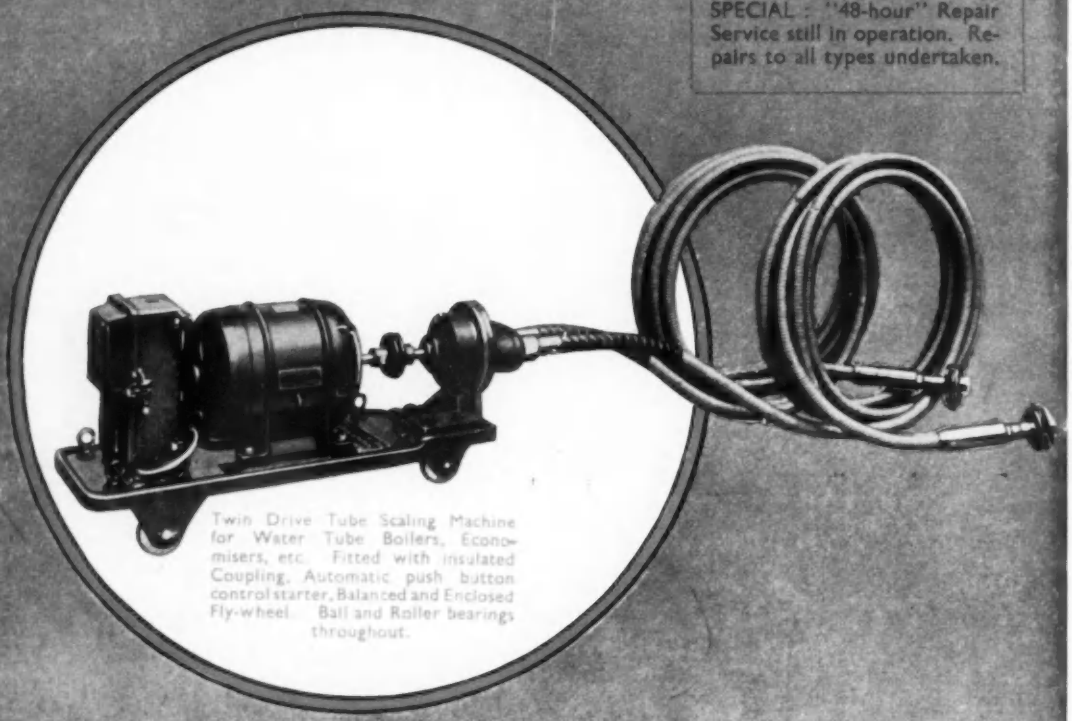
AUTOMATIC CONTROLS AND EQUIPMENT

13, Queensway, London W. 2. Tel.: BAYswater 9321

3041

Flexible Shafts *and* Flexible Shaft Driven Tools

SPECIAL : "48-hour" Repair Service still in operation. Repairs to all types undertaken.



Twin Drive Tube Scaling Machine for Water Tube Boilers, Economisers, etc. Fitted with insulated Coupling, Automatic push button control starter, Balanced and Enclosed Fly-wheel. Ball and Roller bearings throughout.

Grinding, Polishing, Buffing, Sanding, Tube Scaling and Tube Brushing Machines, etc., etc. Manufactured throughout in our own Works. As supplied to War Office, Air Ministry, Admiralty, all leading Railways, and Industrial Organisations in all parts of the world.

THE FLEXIBLE SHAFT MANUFACTURING CO.

(Sole Proprietors : F.S. ENGINEERING LTD.)

TOWN ROAD · EDMONTON · LONDON · N·9

Telephone : Edmonton 3541. Telegrams and Cables : Flexotrans Southtot London.

Atomic Power Stations

Permutit have now obtained contracts for supplying "Deminrolit" plant to six Atomic Power Stations. This follows the successful installation of "Deminrolit" plant for providing feed water for heat exchangers at the world's first Atomic Power Station at Calder Hall. "Deminrolit" plant is but one of a complete range of plants designed and manufactured by Permutit to provide perfect feed water for heat exchangers and boilers of ALL types and pressures.

1 CALDER HALL A
2 CALDER HALL B
3 CHAPELCROSS
4 BRADWELL
5 HINKLEY POINT
6 HUNTERSTON

THE PERMUTIT COMPANY LIMITED

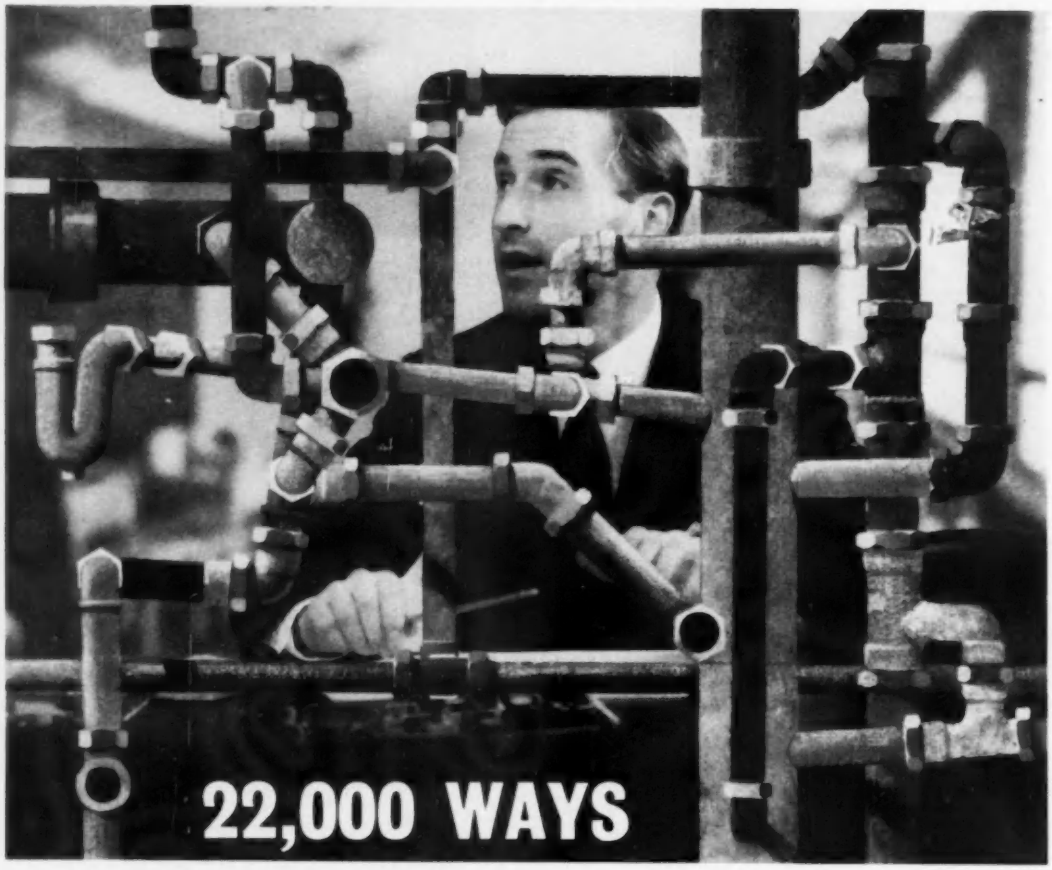
Dept. T.H.348, Permutit House, Gunnersbury Avenue, London, W.4. Tel: CHIswick 6431

SUBSIDIARY COMPANIES

THE PERMUTIT COMPANY OF AUSTRALIA PTY. LIMITED
567-573 Pacific Highway, Crow's Nest, Sydney, N.S.W.

THE PERMUTIT COMPANY OF SOUTH AFRICA (PTY) LTD.
P.O. Box 6937, Johannesburg.

ION EXCHANGE (CANADA) LTD. *33 Price Street, Toronto 5, Ontario.*



OUT OF A PIPELINE PROBLEM!

Whatever the job, whatever the problem, call for KONTITE pipe fittings and set your mind at rest. There are over 22,000 different types and sizes of KONTITE compression fittings—the largest range in the world. 22,000 ways of solving your problem perfectly. KONTITE joints are easily made at the turn of a spanner, they save time, labour, and costs. KONTITE fittings are made in gunmetal to resist corrosion for all sizes of pipe up to 6 in. bore. Kay's make a point of speedy service. Whatever fittings you need can be delivered within days—most items by return. Write for fully illustrated catalogue of KONTITE fittings.

Plan right with Kontite

KAY & COMPANY (ENGINEERS) LTD · BOLTON · LANCS · TELEPHONE: BOLTON 3041
LONDON OFFICE: 36 VICTORIA STREET · SW1 · TELEPHONE: ABBEY 2144

A MEMBER OF THE ALENCO GROUP OF COMPANIES

LANCASTRIAN Oil-Firing Equipment . . .

For Steam Boiler Application

Available with manual or semi-automatic controls and suitable for incorporation in new boiler installations or for conversions from solid fuel to oil-firing. Burns fuel of 950 sec. Redwood No. 1 (at 100° F.) or 3,500 sec. Redwood No. 1 (at 100° F.). Two sizes of Register with six choices of fuel sprayer give heat output range of approx. 694,000 B.T.U./hr. to approx. 11,200,000 B.T.U./hr.

- ★ **Rapid warm-up from cold.**
- ★ **High combustion efficiencies.**
- ★ **Constant performance over wide burning range.**
- ★ **High C O_2 value with freedom from smoke.**
- ★ **Pressure atomisation.**
- ★ **Low pressure forced draught air supply.**
- ★ **Quick release safety sprayer.**
- ★ **Negligible maintenance.**
- ★ **No rotating parts in the oil burner.**
- ★ **Robust fabricated steel construction.**
- ★ **Steam purging device enables fuel to be cleared from the fuel sprayer before removal.**

LUCAS

JOSEPH LUCAS (HYDRAULIC & COMBUSTION EQUIPMENT) LTD.
THE RADLEYS · BIRMINGHAM 33 phone — MARSTON GREEN 2281
A Subsidiary Company of Joseph Lucas (Industries) Ltd.
Also at TORONTO, CANADA — SYDNEY, AUSTRALIA

Believed to be the largest Deaeration plant in the world

THORPE MARSH

Central Electricity Generating Board Power Station

Main Turbo-Alternator and Feedwater Heating Contractors.
C. A. Parsons & Co., Ltd.

One 'Boby' Feedwater Heating Deaerator is to be installed — capacity 3,600,000 lb/hr. in conjunction with a 550 MW Turbo-Generator

WATER
BOBY
TREATMENT

WILLIAM BOBY & CO. LTD.
RICKMANSWORTH HERTFORDSHIRE, ENGLAND

Telephone: Rickmansworth 4251*

Established 1875

the NEW PROCTORS UNIT WIDE-RAM COKING STOKER

Designed specifically to comply with all the provisions of the "Clean Air Act." The result of intensive research, backed by nearly a century's experience in the designing and manufacture of Stoking equipment—here is a Coking Stoker produced to operate *smokelessly*, not only at full boiler output but also at extremely low loads with maximum efficiency. Look at these special Proctor features.

★ **Independent** Unit fitted to each furnace flue with infinitely variable feed control of grate and feeding mechanism.

★ **Extra Wide Ram** giving complete fuel coverage of the grate (particularly the sides).

★ **Selfcleaninggrate** of the well-known and proved Proctor design. Ensuring long life and freedom from excessive "riddlings" when burning coals containing a large percentage of "fines."

This new Coking Stoker, with its unique feature and low operational cost, is offered at an extremely competitive price.

Full specification, test results, and opportunity to inspect an installation from:

JAMES PROCTOR LIMITED

P.O. BOX No. 19 · HAMMERTON STREET · BURNLEY 1 · *Phone 3102/3*

Specialists in the design and manufacture of Stoking Equipment.

for ***Craftsmanship and Dependability***

Installation of ***FUEL SAVING ECONOMIC type BOILERS***

Manufactured by

STOCKTON CHEMICAL ENGINEERS & RILEY BOILERS LTD.

PERSEVERANCE WORKS, STOCKTON-ON-TEES

Tel: 67841 *Telegrams:* "Boiler" Stockton-on-Tees

Also makers of:-

VERTICAL, LANCASHIRE, MARINE AND WASTE HEAT BOILERS, STEEL CHIMNEYS, VESSELS AND TANKS

REAVELL ASKANIA REGULATORS

★

Combustion control for Boilers and Furnaces of all types, Pressure, Vacuum, Mixture and Temperature Regulators for Gases, Steam, Air, Liquids, for

Gas Works, Coke Ovens, Boiler Plant, Steel and Chemical Works, and Industrial Plants Generally

Write for particulars, mentioning this journal

REAVELL & Co. Ltd.
RANELAGH WORKS, IPSWICH

Instrumentation in the boiler house

ensures correct conditions and fuel economy

Temperature . . .

Mercury-in-Glass, Mercury-in-Steel,
Electrical; indicating and recording thermometers.

Draught . . .

Indicating and recording gauges.

Pressure . . .

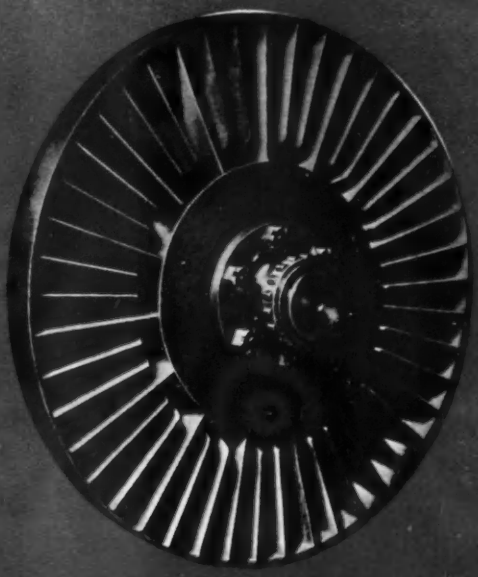
Indicating and recording gauges.

NEGRETTI & ZAMBRA

Manufacturers of instruments for the indication, recording, controlling of : Temperature, pressure, liquid level, volume, specific gravity, humidity, etc.

NEGRETTI & ZAMBRA LTD.
122 REGENT STREET, LONDON, W.1
Telephone : REGent 3406 *Telegrams : Negretti, Piccy, London*

Branches :
Birmingham, Cardiff, Glasgow, Leeds, Manchester, Nottingham.
Subsidiaries or Agents in most countries.

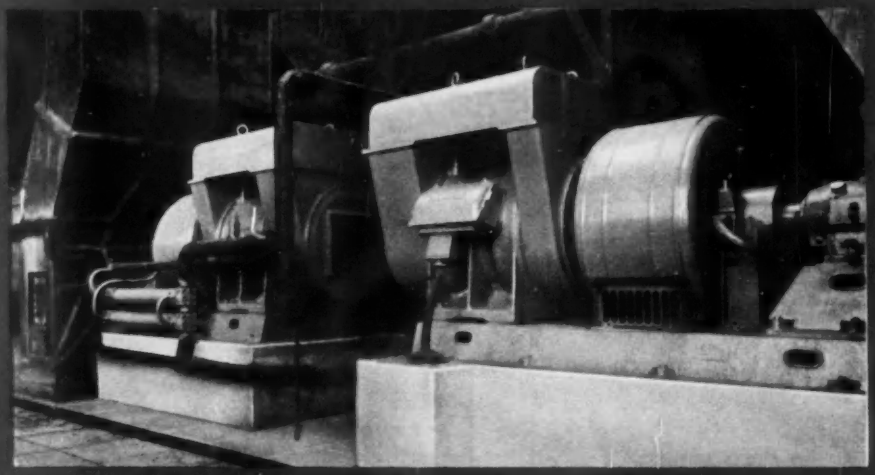


Why Fluidrive

- Infinitely variable speed regulation
- Admirably suited to automatic control
- Efficiency combined with simplicity
- Off-load start for S.C. motor
- Maintenance reduced to absolute minimum

FOR

BOILER DRAFT FANS



I.D. fan drives with S.C. motors of 475 h.p. at 980 r.p.m. and size 41 Vulcan-Sinclair scoop-control fluid couplings at Dublin Smith Power Station of the N.E. Division of the Central Electricity Generating Board.

FLUIDRIVE ENGINEERING CO. LTD.

FLUIDRIVE WORKS • WORTON ROAD • ISLEWORTH • MIDDX.

There's a Lagonda way to clean any tube

Lagonda tube cleaners are designed to remove all types of deposits from all types of tubes. The scraper head will clear tubes as small as ½" and upwards . . . drills from ⅞" up will break down the toughest deposit. Expanding brushes, and sectional brushes will leave tubes from ¾" up as clean as new. And for even smaller tubes, there is a wide assortment of drills and brushes.

The illustration below is only a partial listing of Lagonda equipment, but enough to indicate that the scope of the Lagonda range covers just about any tube you may need cleaned. If you have a tough tube cleaning job, write for the Lagonda Catalogue No. Y-48.

Lagonda TUBE CLEANERS

made by Consolidated Pneumatic

CONSOLIDATED PNEUMATIC TOOL COMPANY LIMITED · DAWES ROAD · LONDON · S.W.6

CP183

My friend will now perform an amazin' trick . . .

He's limbering up to demonstrate that you can fit the Spirax 'TD' upside down if you want to. Or sideways.

Actually, it's no more amazing than all the other virtues of the remarkably versatile Spirax thermodynamic steam trap.

For instance ? No adjusting or valve changing over its whole pressure range of 8-350 psi. Only one moving part—a stainless steel disc (how about that for maintenance ?). Blast discharge action and clean cut-off, with astonishing capacities. Temperature limit 550° F.

It takes superheat, waterhammer, vibration, corrosive condensate and freezing in its stride. (Try freezing one and then thawing it out with a blowlamp—that really *is* an amazin' trick.)

You can have the 'TD' screwed ($\frac{3}{8}$", $\frac{1}{2}$" and $\frac{3}{4}$", all stainless steel) or flanged ($\frac{1}{2}$" and $\frac{3}{4}$", forged steel with stainless steel inserts). All except the $\frac{3}{8}$" have inbuilt stainless steel strainers.

And it's so small, so handy to order and stock. Not to mention fitting.

★ ★ ★ ★ ★

So it's the universal steam trap, is it ? No, there's no such thing. Even the Spirax 'TD' has one or two limits—but within them it's a humdinger. May we bring you up-to-date (especially on the new lower prices)?

SPIRAX - SARCO

Please send more than the bare details of the Spirax 'TD' steam trap range

NAME

ADDRESS

EB 1159

Spirax-Sarco Ltd. Cheltenham Glos. Phone: Cheltenham 5173 Spirax Telex Cheltenham London: 28 Victoria Street SW1 Abbey 6101-3832

Damaging Slag and Carbon build-up is no longer a problem

DOHMseal, applied to existing refractory linings by brush or to new linings by the "Dipped Brick" technique, forms a tough resistant glaze that retards the build-up of Carbon and Slag and extends the "maintenance free" life of the lining.

These undesirable deposits will eventually form but DOHMseal ensures their easy removal without damage to the refractory lining.

Fuel saving and reduced maintenance costs result from the use of DOHMseal, which more than pays for the small expenditure incurred.

Repair refractory linings and fabricate monolithic refractory shapes with DOHMpatch—finish with DOHMseal.

CENTRAL ELECTRICITY AUTHORITY.
STOKE GENERATING STATION.

Close-up of slag adherance chipped away, showing DOHMseal treated bricks beneath. Without the application of DOHMseal the boilers need to be rebricked every six months.

By treating bricks with DOHMseal, which allows easy removal of slag, there is no necessity to rebrick for a year or more.

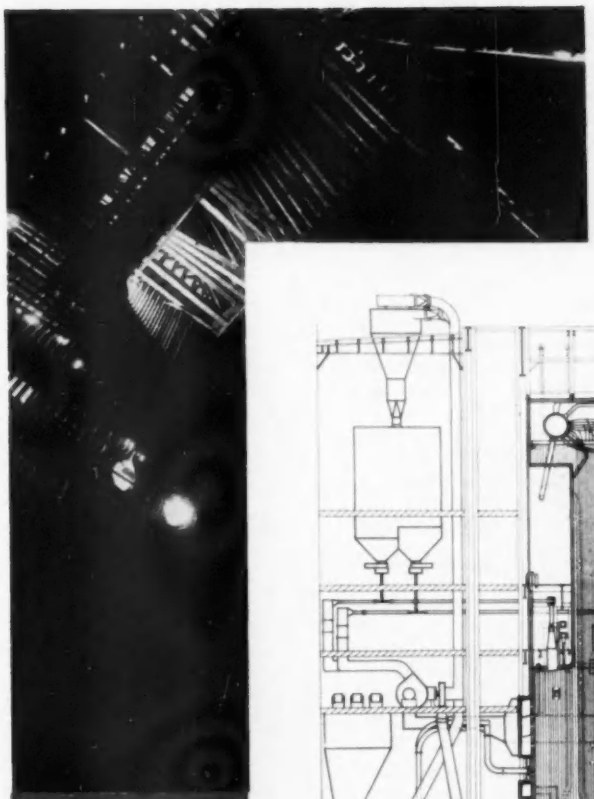
Write or telephone for full details:

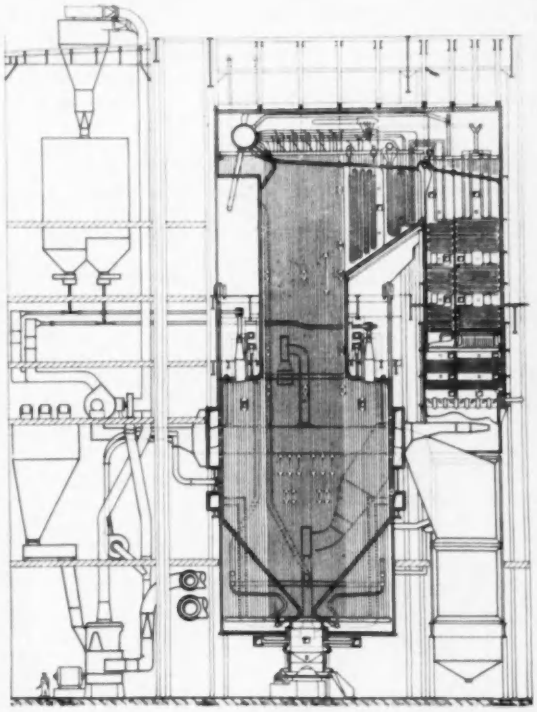
MELLOR MINERAL MILLS LTD.

ONE OF THE DOHM GROUP OF COMPANIES

Etruria Vale,
Stoke-on-Trent,
Staffs.

Stoke-on-Trent 23441/5





Complete heating systems for power stations for all pressures or temperatures of superheat : Cockerill-Ougrée type for pressures up to 80 kg per sq. cm. or Stein and Roubaix type, applying the processes developed by Combustion Engineering of New York and K. S. G. of Stuttgart for higher pressures.

COCKERILL - OUGREE

SERAING - Belgium

Damaging Slag and Carbon build-up is no longer a problem

DOHMseal, applied to existing refractory linings by brush or to new linings by the "Dipped Brick" technique, forms a tough resistant glaze that retards the build-up of Carbon and Slag and extends the "maintenance free" life of the lining.

These undesirable deposits will eventually form but DOHMseal ensures their easy removal without damage to the refractory lining.

Fuel saving and reduced maintenance costs result from the use of DOHMseal, which more than pays for the small expenditure incurred.

Repair refractory linings and fabricate monolithic refractory shapes with DOHMpatch—finish with DOHMseal.

CENTRAL ELECTRICITY AUTHORITY. STOKE GENERATING STATION.

Close-up of slag adherance chipped away, showing DOHMseal treated bricks beneath. Without the application of DOHMseal the boilers need to be rebricked every six months.

By treating bricks with DOHMseal, which allows easy removal of slag, there is no necessity to rebrick for a year or more.

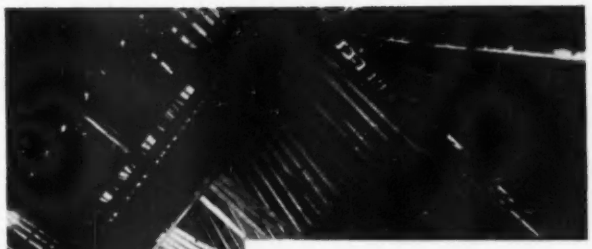
Write or telephone for full details:

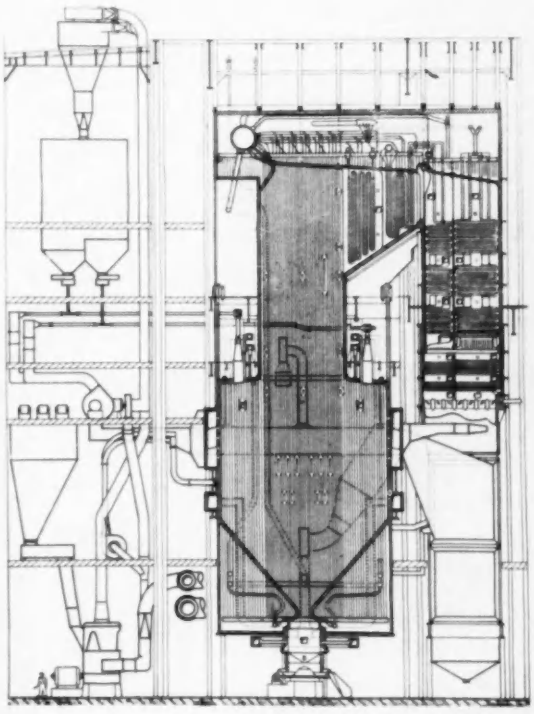
MELLOR MINERAL MILLS LTD.

ONE OF THE DOHM GROUP OF COMPANIES

Etruria Vale,
Stoke-on-Trent,
Staffs.

Stoke-on-Trent 23441/5





Complete heating systems for power stations for all pressures or temperatures of superheat : Cockerill-Ougrée type for pressures up to 80 kg per sq. cm. or Stein and Roubaix type, applying the processes developed by Combustion Engineering of New York and K. S. G. of Stuttgart for higher pressures.

COCKERILL - OUGREE

SERAING - Belgium

starting with Zerox*

The first *complete* Power Station to operate at 1,500 p.s.i. and 1050°F. was opened at Drakelow in October 1955. Right from the beginning, Zerox (35% hydrazine) was chosen for the treatment of the boiler feed water. By the end of the first year, Drakelow had proved itself to be the most efficient Power Station of its kind in Great Britain. Since then it has completed a further two years of exemplary service for the East Midlands Division of the Central Electricity Generating Board, maintaining, for this type and design of Station, an unsurpassed standard of performance.

Zerox, an ideal method of removing dissolved oxygen *throughout* the steam/water cycle, is particularly suitable for high-pressure working. Furthermore, Zerox does not increase the dissolved solids and, far from producing acidic substances, actually helps to keep the water alkaline.

The results—less blow-down, purer water, cleaner internal surfaces—explain why Drakelow and numerous other Power Stations use Zerox

*Regd. Trade Mark

to ensure maximum efficiency

For more FACTS about ZEROX, its advantages and application, write to WHIFFENS, sole manufacturers, for Leaflet H/H/2—or for the fully bound book of the International Conference on Hydrazine and Water Treatment held in May 1957. Price one guinea, plus 2s. 6d. postage and packing (in the U.K.)

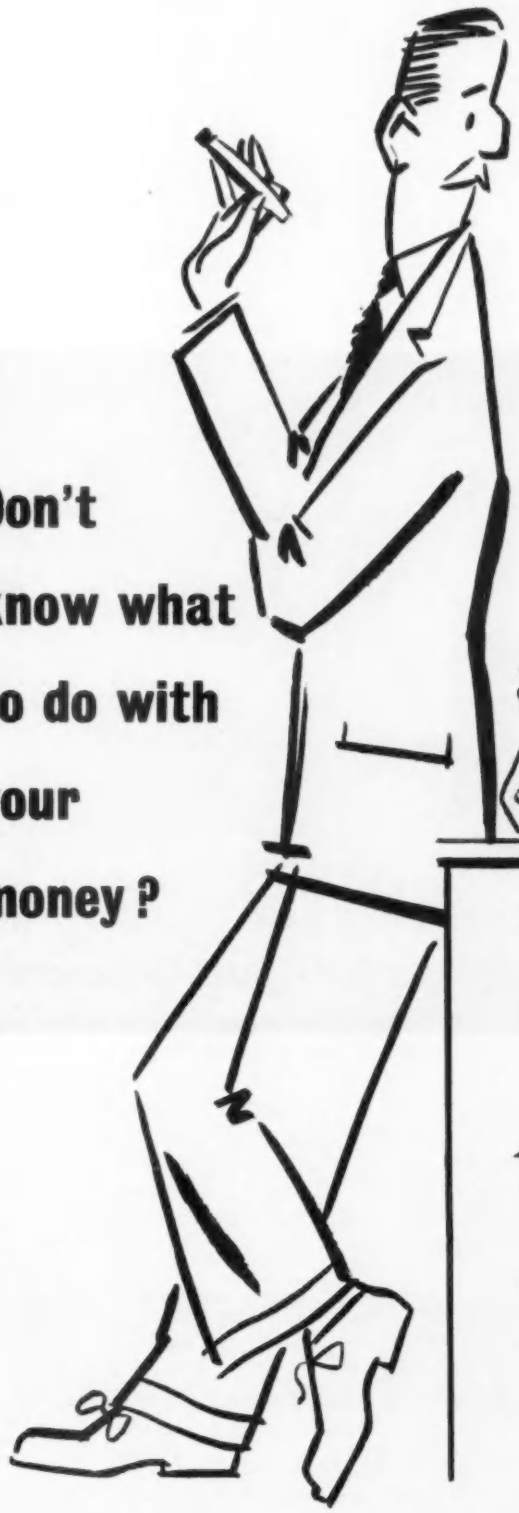
WHIFFENS

A member of the Fisons Group of Companies

chemicals for industry

WHIFFEN & SONS LTD., Willows Works, Derby Road, Loughborough, Leicestershire.
Tel: Loughborough 3141
Telegrams: Whiffen, Loughborough, Telex.
Telex No: 34548

W37



Don't know what to do with your money?

The very best investment for any firm having a boiler plant is to install a Green's Economiser; in a short time it will save enough fuel to extinguish its capital cost and will thereafter provide a handsome dividend throughout its long life.

With fuel costs rising continually, there is no better investment.

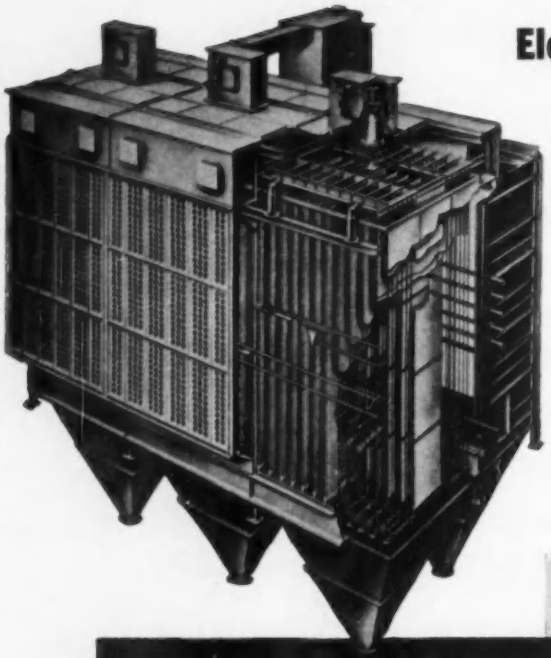
. . invest it in a

GREEN'S ECONOMISER

E. GREEN & SON LIMITED · WAKEFIELD

Makers of economisers for more than one hundred years

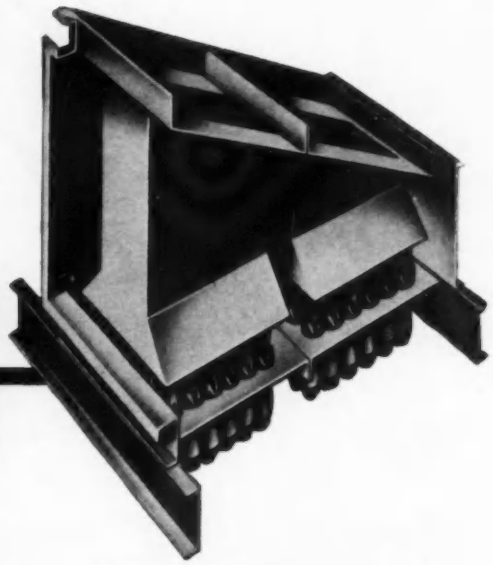
GE155



Electrostatic Precipitators

Made under licence from the Aerotec Corpn., U.S.A., these precipitators have an extremely high collection efficiency, low current consumption and many novel design features including screen-grid type collecting electrodes which minimise re-entrainment and consequent emission of dust. Manufactured in several combinations of width, height and length to suit available space in existing plants or most efficient usage of building volume in new constructions.

PD–KB



Multitubular Dust Collectors

Here is a dust collector which satisfies the ideal requirements of steam generator designers. It has a high collection efficiency at moderate resistance; maximum freedom from dust erosion; accessibility for maintenance and service; simple, low cost erection; flexibility of arrangement to meet space availability conditions. These collectors can be used in series with electrostatic precipitators and can be designed to match the precipitator inlet.

Induced & Forced Draught and Grit Arresting Fans

The product of over 75 years of experience, 'Tornado' induced and forced draught fans can handle any boiler draught requirements efficiently and reliably. The type A.R. aerofoil section backward bladed centrifugal fan, with peak efficiency of 90%, is only one of the many types (another is the combined induced draught and grit arrester) produced to deal with all classes of boilers from central heating to those in the largest power stations.

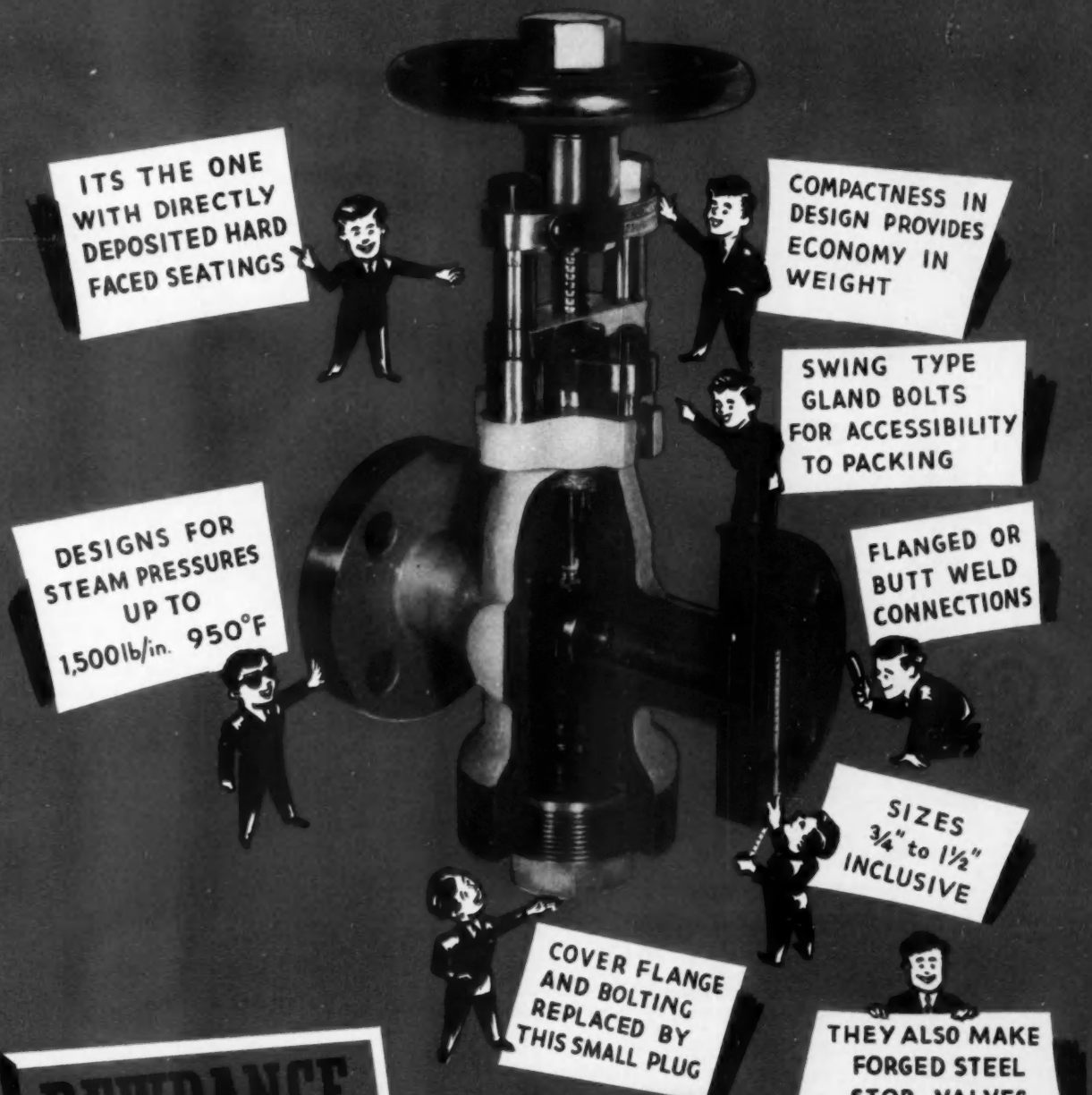
for CLEAN AIR

KEITH BLACKMAN LTD
(Incorporating Blackman Export Co Ltd)
MILL MEAD ROAD · LONDON N.17
in collaboration with Prat-Daniels (Stroud) Ltd., Whitecroft, Nailsworth, Gloucester

TA.97

For the most severe service conditions

Install **DEWRANCE** **FABRICATED PARALLEL SLIDE VALVES**


ITS THE ONE WITH DIRECTLY DEPOSITED HARD FACED SEATINGS
COMPACTNESS IN DESIGN PROVIDES ECONOMY IN WEIGHT
SWING TYPE GLAND BOLTS FOR ACCESSIBILITY TO PACKING
DESIGNS FOR STEAM PRESSURES UP TO 1,500lb/in. 950°F
FLANGED OR BUTT WELD CONNECTIONS
SIZES 3/4" to 1½" INCLUSIVE
COVER FLANGE AND BOLTING REPLACED BY THIS SMALL PLUG
THEY ALSO MAKE FORGED STEEL STOP VALVES NON-RETURN VALVES MONOWAY VALVES

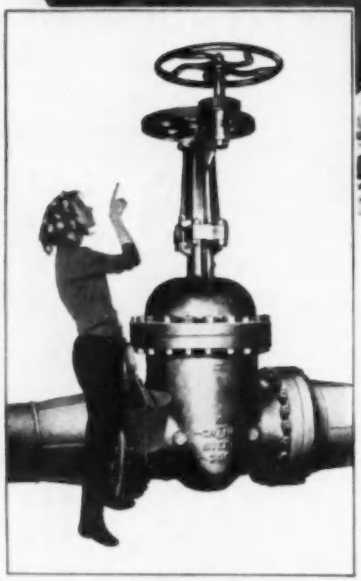
DEWRANCE
AND COMPANY LTD.

GREAT DOVER STREET,
LONDON, S.E.1.

TELEPHONE: HOP 3100 (12 lines)

WORKS: LONDON · BRADFORD · DUMBARTON · HILLINGTON

"How do Crane giant valves help to feed my piglets?"



THE pigs, of course, couldn't care less, but the farmer's wife finds it amazing that CRANE giant valves help to keep them well fed. However at the Pfizer Organisation, a large chemical producing factory, there is a department specialising in preparations used in pig feeding. And here these valves are performing vital duties during the early processing stages. The industries which CRANE giant valves serve are varied and numerous . . . and the giant valve is only one among a wide variety of CRANE valves—ranging from ¼" to 24"—each with a tradition of reliable, efficient service. CRANE's reputation for reliability lies in their high standard of design, production and precision testing methods.

Among the country's largest industries using CRANE giant valves are :
Esso Petroleum Co. Ltd · Imperial Chemical Industries Ltd · 'Shell' Refining Co. Ltd Reed & Smith Ltd · British Nylon Spinners Ltd · Pfizer Ltd · Firestone Tyre & Rubber Co. Ltd.

CRANE

VALVES OF BRONZE, CAST IRON & STEEL

CRANE LTD., 15-16 RED LION COURT, FLEET STREET, LONDON, E.C.4. Works: IPSWICH
Branches: Birmingham, Brentford, Bristol, Glasgow, London, Manchester

Guaranteed SMOKELESS COMBUSTION

with the new

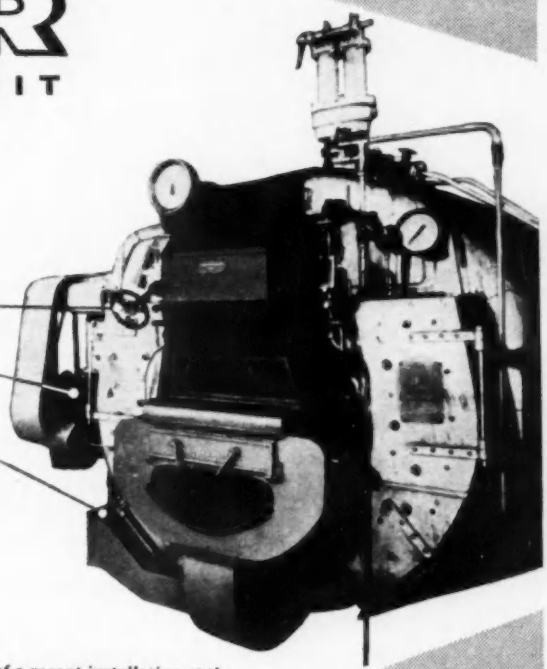
"CL'AIR"

COMBUSTION UNIT

Patent Applied For

FLEXIBLE

Control of fire thickness
Control of Grate Speed
Control of Forced Draught



ECONOMICAL

Low maintenance costs. No Stoker working parts. High Efficiency Self Cleaning Grates. Designed for Low Grade fuels.

Part of a recent installation at the St. Lawrence Hospital, Chepstow.

(Photograph by courtesy of the Hospital Authorities)

GUARANTEED

Smokeless combustion
Grit Free Operation
Full boiler rating.

CUT COSTS WITH

CROSTHWAITE

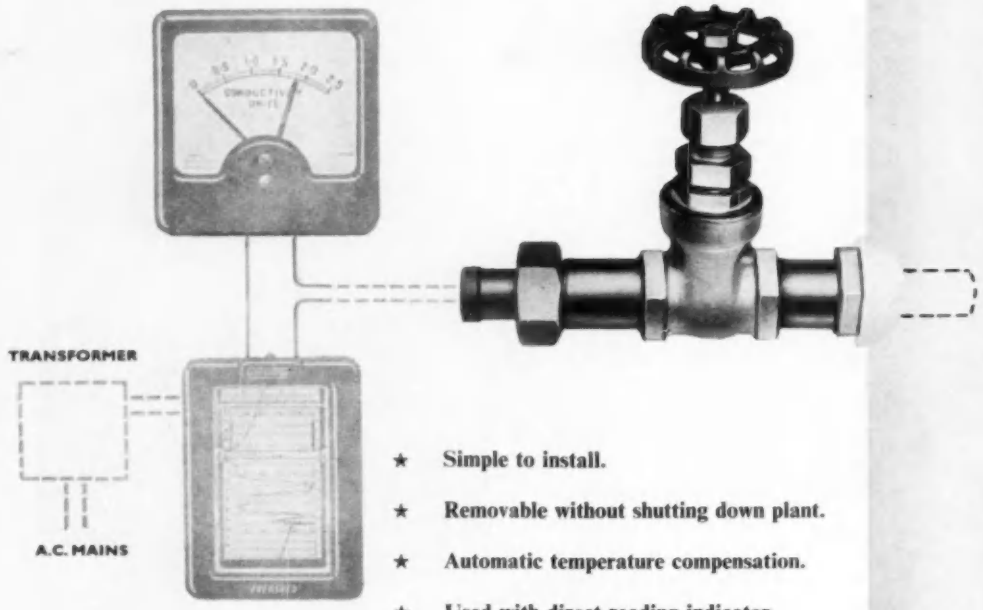
FORCED DRAUGHT FURNACES, AUTOMATIC STOKERS AND COAL & ASH HANDLING PLANT

CROSTHWAITE FURNACES AND SCRIVEN MACHINE TOOLS LTD

York Street Ironworks, LEEDS 9
Telephone 3-2411 & 2

32 Victoria Street, LONDON S.W.1
Telephone ABBey 2966

Pure, Pure Water



- ★ **Simple to install.**
- ★ **Removable without shutting down plant.**
- ★ **Automatic temperature compensation.**
- ★ **Used with direct reading indicator and/or Evershed miniature recorder.**
- ★ **Provides alarm and/or control.**
- ★ **Range from $\frac{1}{2}$–100,000 conductivity units.**
- ★ **Pressure tested to 200 p.s.i.**
- ★ **Operates on A.C. mains.**

The NEW simplest method of checking WATER PURITY constantly is to install a small Dionic unit in your existing piping. The Dionic cell measures the impurity/conductivity level of the fluid and operates a direct reading indicator, miniature recorder, or alarm system.

EVERSHED PIPE-TYPE DIONIC CONDUCTIVITY CELL

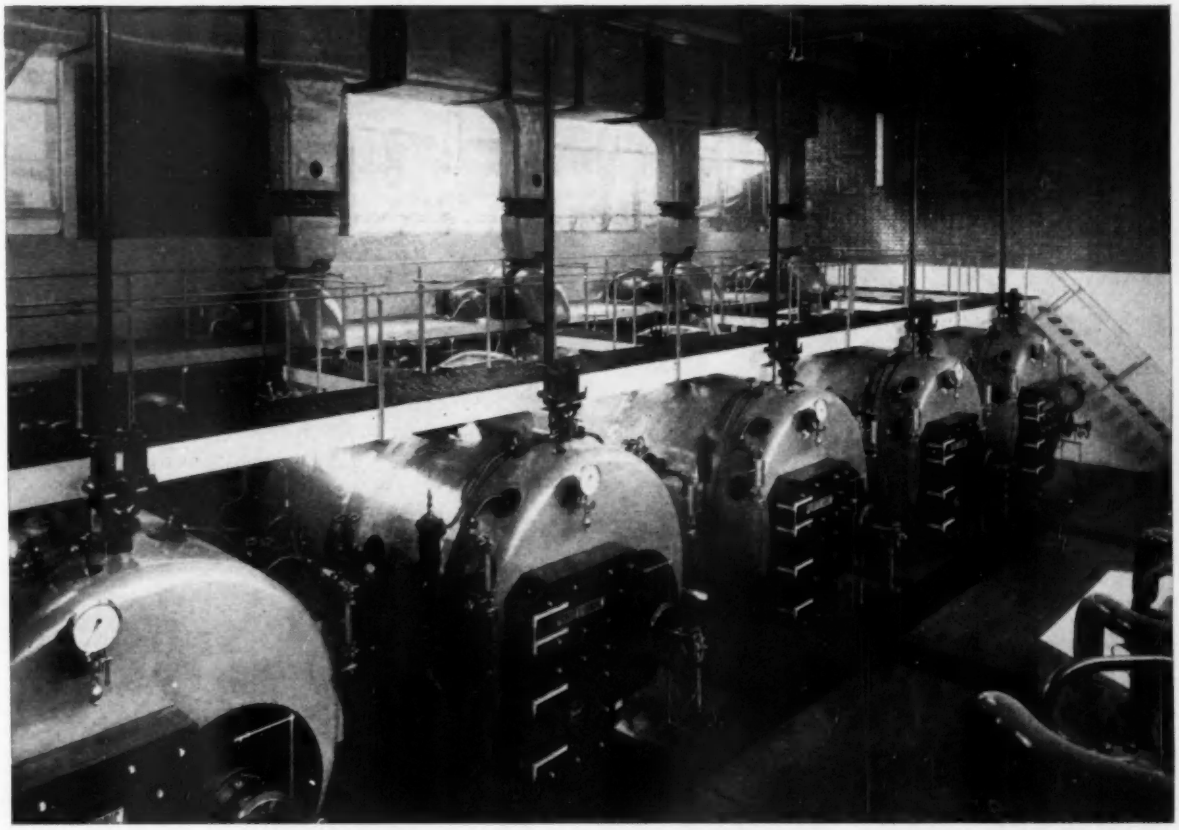
For further details ask for Publication ES.051/50

INSTRUMENTS DIVISION **EVERSHED & VIGNOLES LIMITED**

Acton Lane Works, Chiswick, London W.4 · Telephone: CHiswick 3670 · Telegrams & Cables: Megger London Telex 22583

7/126

DICK'S for ALL Insulation...



Photograph by courtesy of Davey, Paxman & Co. Ltd.

Changing conditions in Industry today call for new materials and new techniques in the field of insulation.

DICK'S are always in the forefront in development, and they have a highly trained staff of technicians who can advise on problems concerning insulation in all its forms.

The photograph shows the insulation of five Davey, Paxman Ultranomic boilers at the Bristol Aeroplane Co. Ltd.

Dick's Asbestos and Insulating Co. Ltd.

EAGLE WORKS, NORTH WOOLWICH ROAD, SILVERTOWN, LONDON E.16.

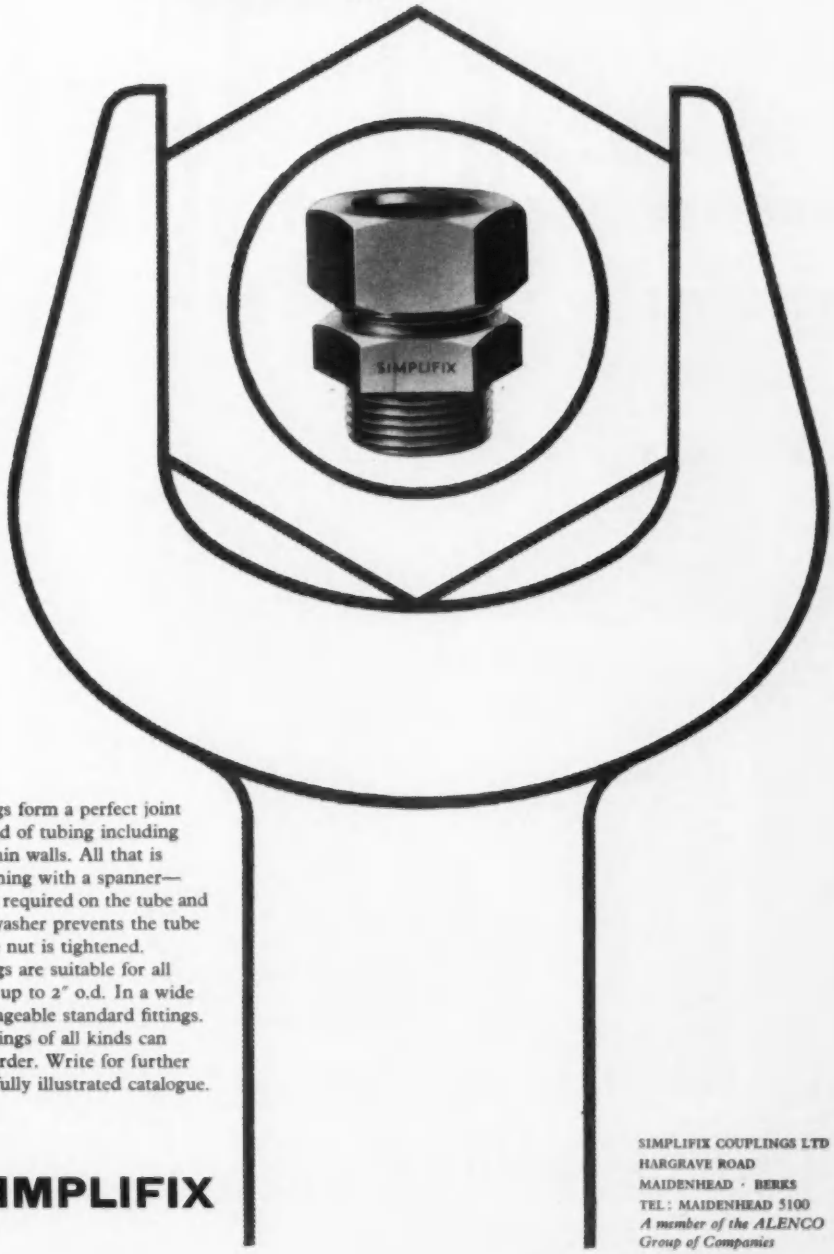
TELEPHONE:- ALBERT DOCK 4311/5

DA.4

Get these out of your system!
These are some of the slime-forming organisms which cause loss of efficiency and blockages in industrial cooling water systems by fouling heat-transfer surfaces, filters, pipes, storage basins and cooling towers. Organic growths can be controlled by chlorination, a simple method which increases efficiency and reduces to a minimum the interruption of plant operation. For advice on the application and handling of liquid chlorine and hypochlorites, consult:
IMPERIAL CHEMICAL INDUSTRIES LTD.,
LONDON, S.W.1
ICI
CH. 76

So simple!

So surely SIMPLIFIX the foolproof coupling!

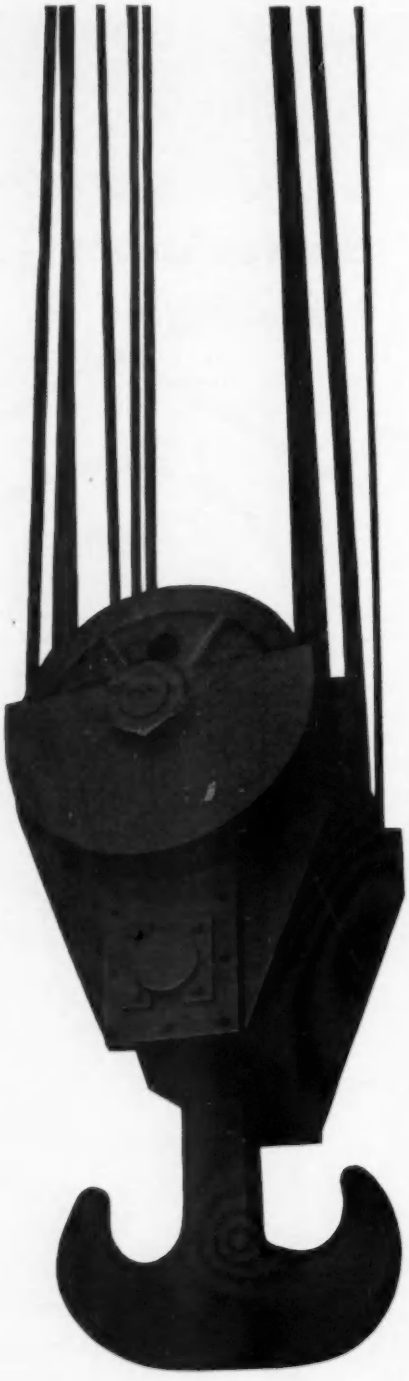


Simplifix couplings form a perfect joint on almost any kind of tubing including those with very thin walls. All that is required is tightening with a spanner—no special work is required on the tube and the anti-friction washer prevents the tube twisting when the nut is tightened. Simplifix couplings are suitable for all pipe line systems up to 2" o.d. In a wide range of interchangeable standard fittings. Non-standard fittings of all kinds can also be made to order. Write for further information and fully illustrated catalogue.

SIMPLIFIX

SIMPLIFIX COUPLINGS LTD
HARGRAVE ROAD
MAIDENHEAD · BERKS
TEL: MAIDENHEAD 5100
A member of the ALENCO Group of Companies

TO LIFT THE LARGEST ALTERNATORS YET ENVISAGED



The hook of the 175 ton 'traveller' in our new turbine shop at Hartlepool. Here we can build, to Brown Boveri design, the largest turbo-alternators yet envisaged. At Hartlepool we, of course, also build small turbines, and many other things besides: industrial turbo-alternators down to 500 kW, gas turbines, axial and centrifugal blowers and exhausters, water-tube boilers of Foster-Wheeler design, Economic type boilers, feed heaters, condensers, rotary cooling-water strainers, etc . . . in fact all the major equipment of a power station.

R W G

RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.

A member of **THE RICHARDSONS WESTGARTH GROUP** which co-ordinates the land and marine activities of:

THE NORTH EASTERN MARINE ENGINEERING CO. LTD.
RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.
PARSONS MARINE TURBINE CO. LTD.
THE HUMBER GRAVING DOCK & ENGINEERING CO. LTD.
GEORGE CLARK & NORTH EASTERN MARINE (SUNDERLAND) LTD.
RICHARDSONS WESTGARTH ATOMIC LTD.

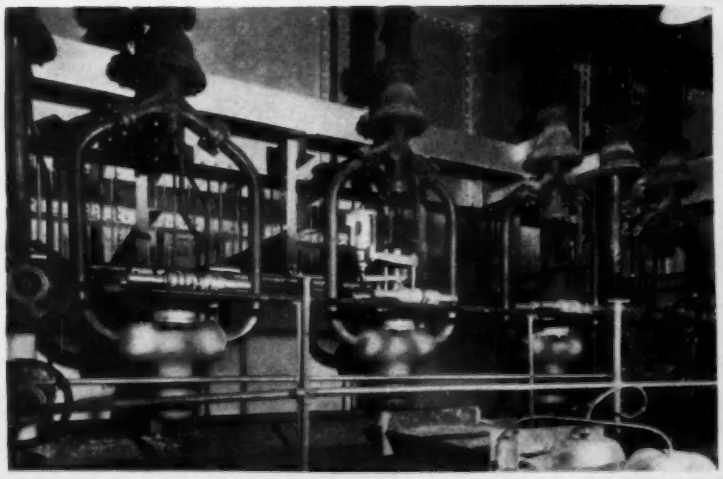
ASSOCIATED COMPANY: ATOMIC POWER CONSTRUCTIONS LTD.

RICHARDSONS WESTGARTH (Hartlepool) LTD., HARTLEPOOL, CO. DURHAM
and at 58 Victoria Street, London, S.W.1. 59 Mosley Street, Manchester, 2. 75 Buchanan Street, Glasgow, C.1

100 OVER 900 psi !

Of the power stations
now operating at over 900 psi
more than one hundred
are equipped with

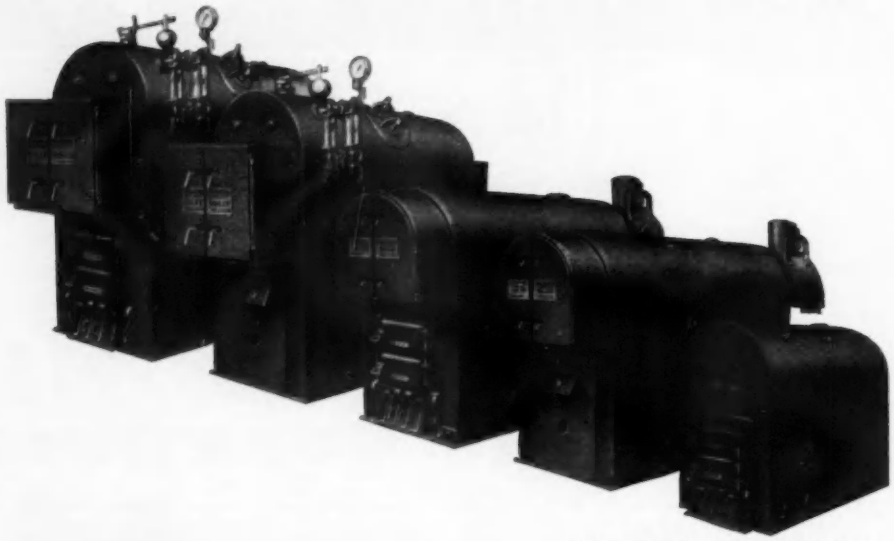
HOPKINSONS'
BOILER MOUNTINGS



HOPKINSONS LIMITED · HUDDERSFIELD

LONDON OFFICE: 34 NORFOLK STREET, STRAND W.C.2

HV 111



Boilers by Hartley & Sugden Ltd., Halifax

A section of copper piping showing heavy scale deposit

The same section after treatment with Starit

A Problem of Scale?

Is there a falling-off in steam raising? Do you suspect metal stress, or serious loss of heat during transfer from fuel to water? These and kindred questions in connection with boilers and feed pipes can be an indication of scale deposit that lowers the efficiency so vital to economical steam raising.

Starit effectively removes most types of scale from boilers and feed pipes, attacking and dissolving the scale to leave the metal in a first-class condition of conductivity. The action of Starit ensures rapid removal of scale deposit, but its effect on boiler plates is inhibited. Starit solution is especially effective for cleaning awkward corners impossible to reach by hand.

Starit is successful in most cases of scale deposit, but as some scale is immune to chemical treatment, send us a sample. We will then determine the suitability of Starit for your particular problem and send you a booklet dealing with the uses of Starit and methods of its application.

The solution is STARIT

TRADE STARIT MARK

STARIT LIMITED DARWEN · LANCS

THESE POWER STATIONS HAVE SOMETHING IN COMMON

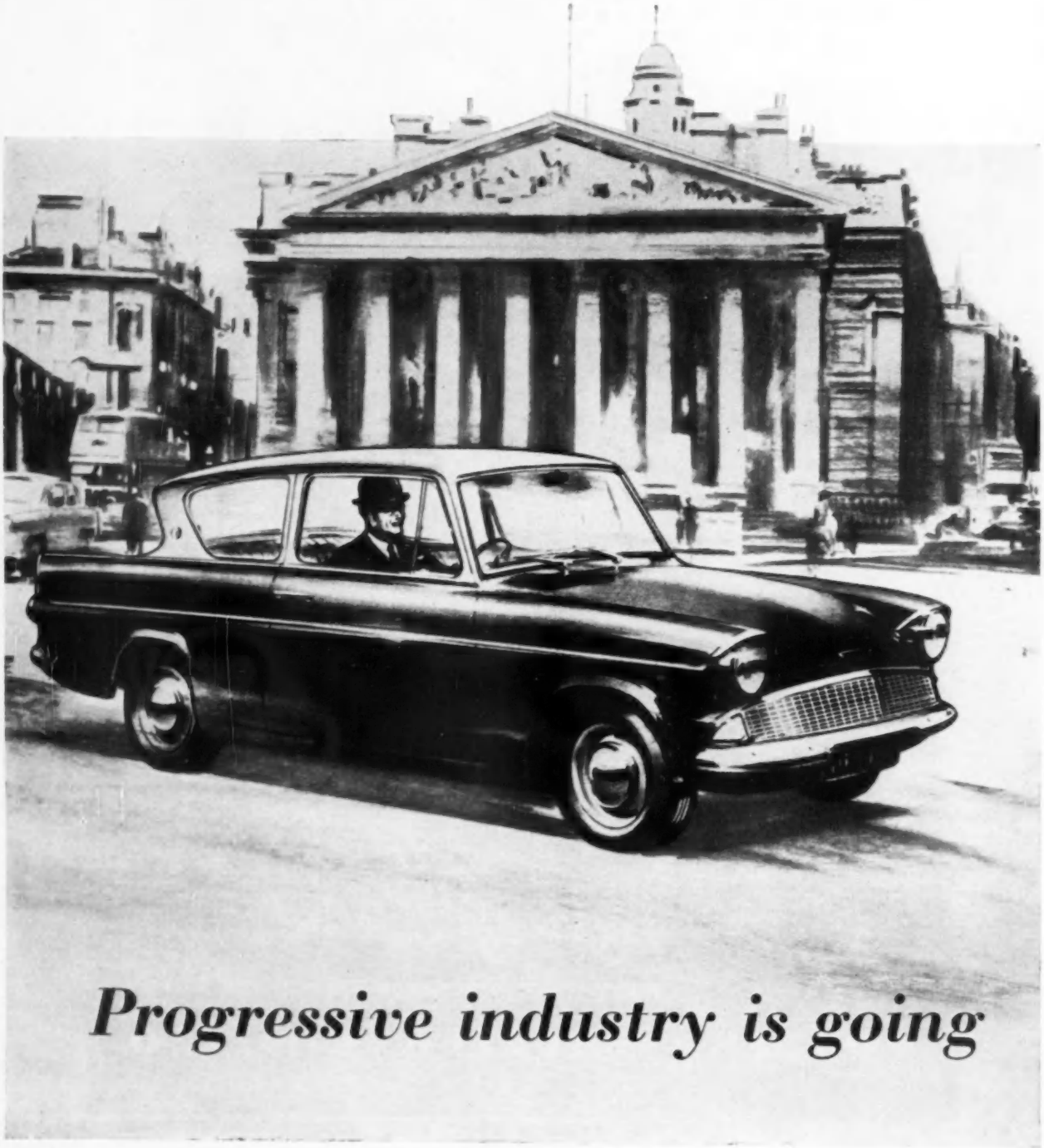
Acton Lane (Willesden) "A", Deptford East (H.P.), Bankside "B", Fleetwood, York, Wakefield "B", Lincoln, Little Barford "B", Mexborough, Aberthaw, Northfleet, Drakelow "B", Spondon "H".

Twenty-one boilers, with a combined maximum continuous rating of 14,120,000 lb. per hour, have been designed for the Central Electricity Generating Board by Foster Wheeler Limited, and are now being installed by them in five power stations.
Since 1946, Foster Wheeler has been responsible for the design of no less than forty-eight boilers totalling 21,050,000 lb. per hour maximum continuous rating, for thirteen C.E.G.B. power stations—a notable contribution to Britain's post-war recovery programme and export drive.

FOSTER WHEELER LIMITED

FOSTER WHEELER HOUSE, 3 IXWORTH PLACE, LONDON S.W.3.

Every FORD



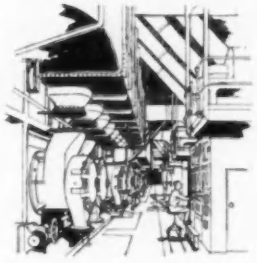
Progressive industry is going

starts on Coal

FIVE STAR MOTORING—gleaming, colourful, swift and safe—begins at Dagenham, a giant factory that covers over 550 acres of a once desolate marsh. The judgment and business acumen of the men who have made Ford one of our great key industries is reflected in every operation in the factory, every decision in the boardroom.

In the impressive steam power plant that supplies the entire factory, coal is the chosen fuel. Coal has been chosen because pulverised coal—fired in powder form—*gives accurately controlled heat with the lowest fuel bills.* Coal has the invaluable long-term advantage that it is a home-produced fuel which can supply all the fuel needs of British industry for decades to come.

If your voice is a deciding one in the choice of fuels, remember Ford. Beneath its smokeless chimneys is a wealth of knowledge and applied experience that is an invaluable example of hard thinking and wise decisions. Ford say *coal.* That's five-star wisdom.



Here are some key facts and figures about the Ford main power station

Number of boilers. . 4 high-pressure water-tube boilers, with superheaters, airheaters and economisers
Steam pressure . . . . . 1250 lbs. per sq. inch
Steam temperature. . . . . 940°F
Feed temperature. . . . . 380°F
Continuous maximum rating. . . . 1,000,000 lbs. of steam per hour (largest unit 400,000 lbs. per hour)
Method of firing . . . . . Pulverised fuel
Fuel. . . . . Coal

ISSUED BY THE NATIONAL COAL BOARD

forward on **COAL**

Length of fibre

is one of the virtues of

FIBREGLASS CROWN

FIBREGLASS CROWN is the new thermal and sound insulation material.
The fibres which make it up are longer and finer than ever before. This gives it *good cohesion* and higher tear strength. There are no coarse fibres and no shot. This means that *all* the glass is effective.
How effective? Let us simply remind you that the finest insulation of all is still air, and point out that Fibreglass Crown is, by volume, 99.52% still air. Can't get much closer than that, can you?

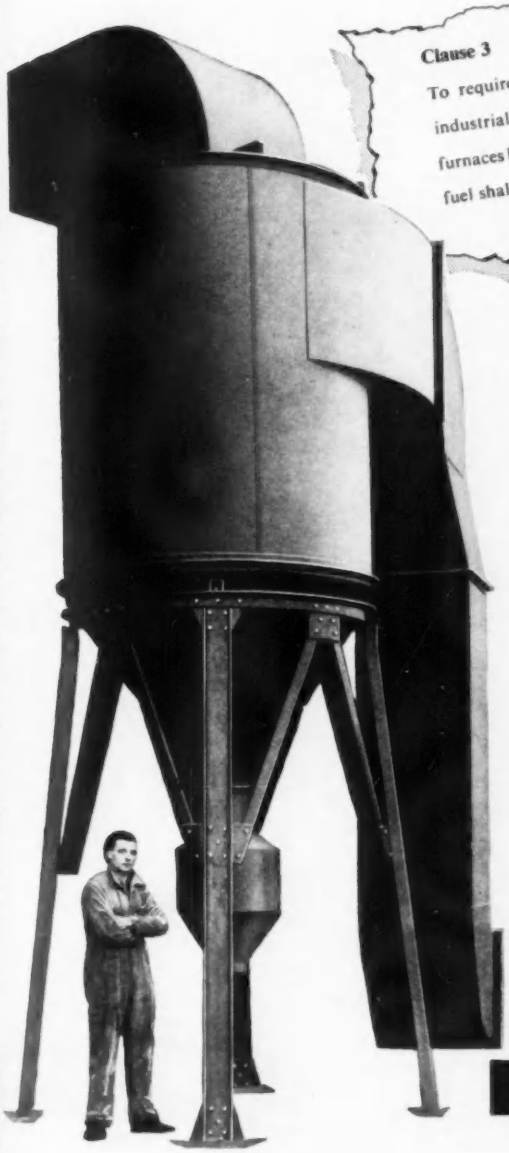
There are other advantages to Fibreglass Crown —a whole list of them.
At the drop of a hint, we will tell you all about them. We will also detail the applications for which Fibreglass Crown is available now and those for which it will be ready soon.
If you are concerned in any way with better insulation, please ask us.

Fibreglass Limited, St. Helens, Lancs. St. Helens 4224

CLEAN AIR ACT 1956

Clause 3

To require that the emission of grit and dust from existing industrial furnaces shall be minimised and that new industrial furnaces burning pulverised fuel or large quantities of other solid fuel shall be provided with approved grit-arresting equipment.



Cyclone Patent Grit Arrester installed at Reading.

the

CYCLONE

GRIT ARRESTER

(Patented)

Clearly and economically meets the bill

For many years, Cyclone Equipment has led the field for efficiency and economy in the production of equipment related to air movement, purification and conditioning.

This Patent Grit Arrester embodies all the proven experience and resultant simplicity, efficiency and economy inherent in all our products.

It is your best 'Back answer' to the new Act and probably the least expensive.

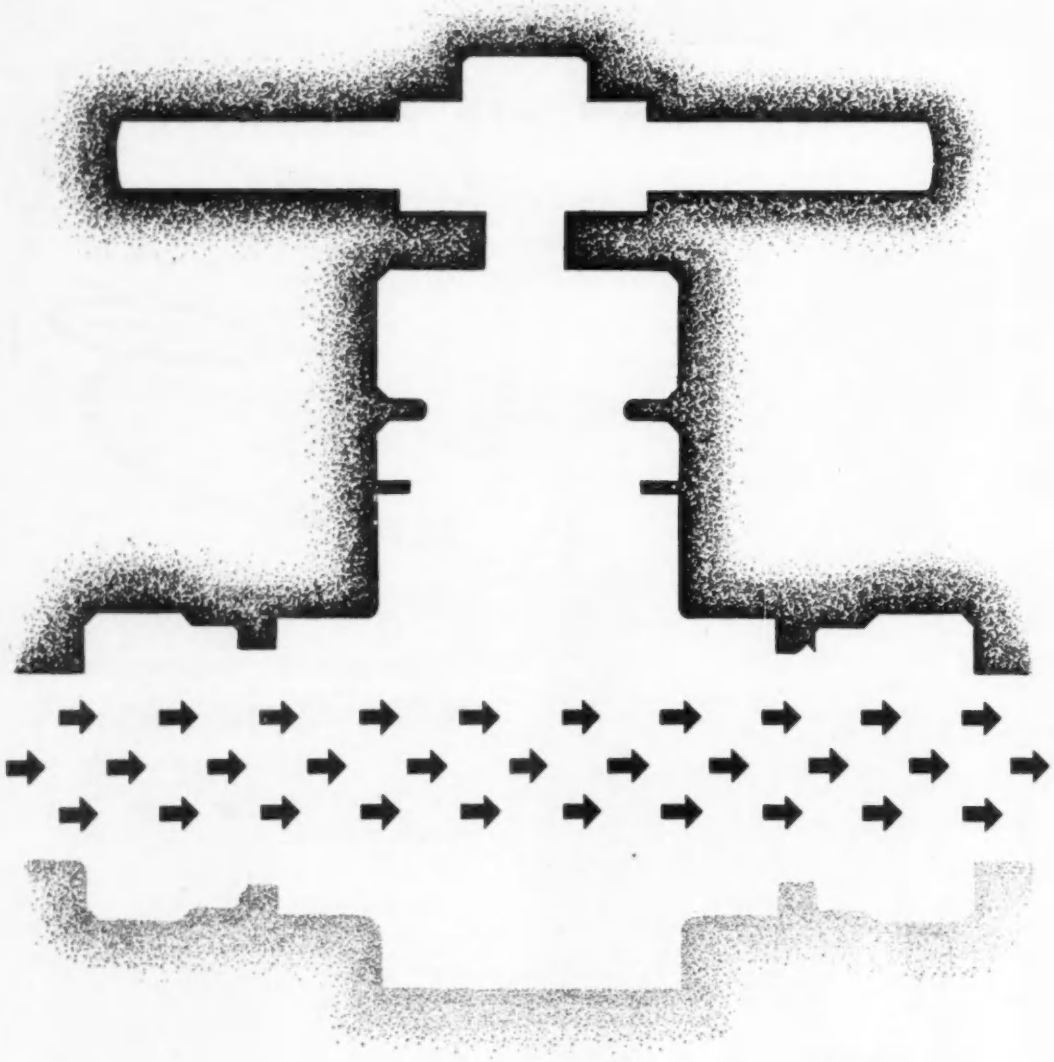
May we send you literature?

MATTHEWS & YATES LTD

CYCLONE WORKS · SWINTON · MANCHESTER
& 135 RYE LANE · PECKHAM · LONDON S.E.15

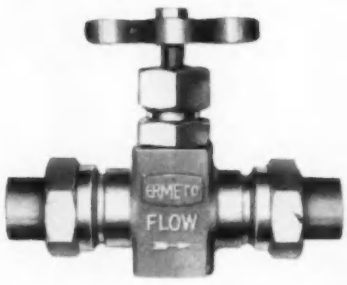
Telephone: SWINTON 2273 (4 lines)
Telephone: NEW CROSS 6571 (4 lines)

Also at:
Glasgow · Leeds · Birmingham · Cardiff · Bournemouth



in connection with high pressure

ERMETO VALVES, incorporating the famous **ERMETO** High Pressure Couplings are designed for use with a wide range of fluids, and are tested to one and a half times the recommended working pressure. They are available with standard Ermeto end connections. Non-standard valves can be made by special arrangement. Technical advice and fully illustrated catalogue will be supplied on request.



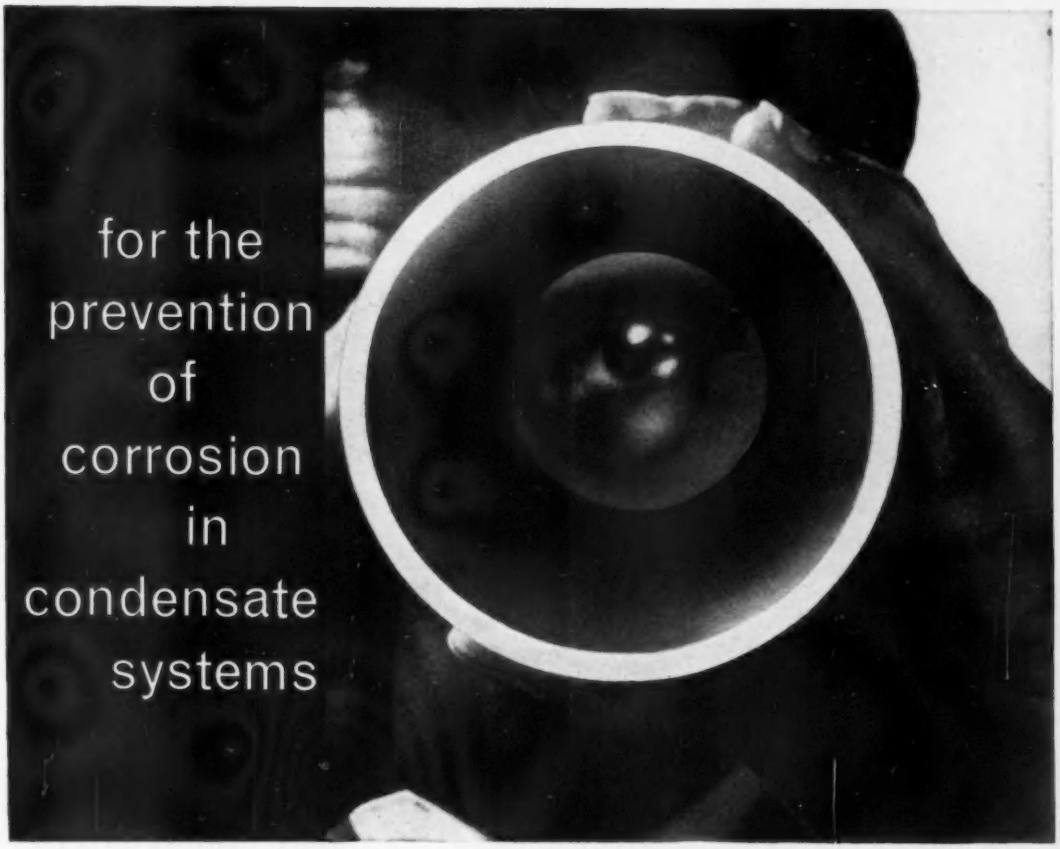
ERMETO

BRITISH ERMETO CORPORATION LTD

HARGRAVE ROAD · MAIDENHEAD · BERKS · TELEPHONE: MAIDENHEAD 5100

A member of the ALENCO Group of Companies

HAGAFILM



Corrosion kills efficiency. Hagafilm promotes efficiency—because it kills corrosion! In space heaters, process heaters, evaporators and condensate lines Hagafilm forms a non-wettable film that protects vital surfaces from corrosion and improves heat transfer to a remarkable degree. Hagafilm has for long been used in America with striking results. Now in the United Kingdom it is showing the same efficiency, and reducing maintenance and replacement costs considerably.

Wherever there is plant using steam, Albright & Wilson chemicals and technical service have a vital role to play. For example, phosphates are supplied for boiler water treatment. The phosphate conditioning of boiler water is now established as the best method of preventing scale deposits in all types of boilers.

For full details write to:

ALBRIGHT & WILSON (MFG) LTD

1 KNIGHTSBRIDGE GREEN · LONDON SW1 TEL: KENSINGTON 3422 TBW.509

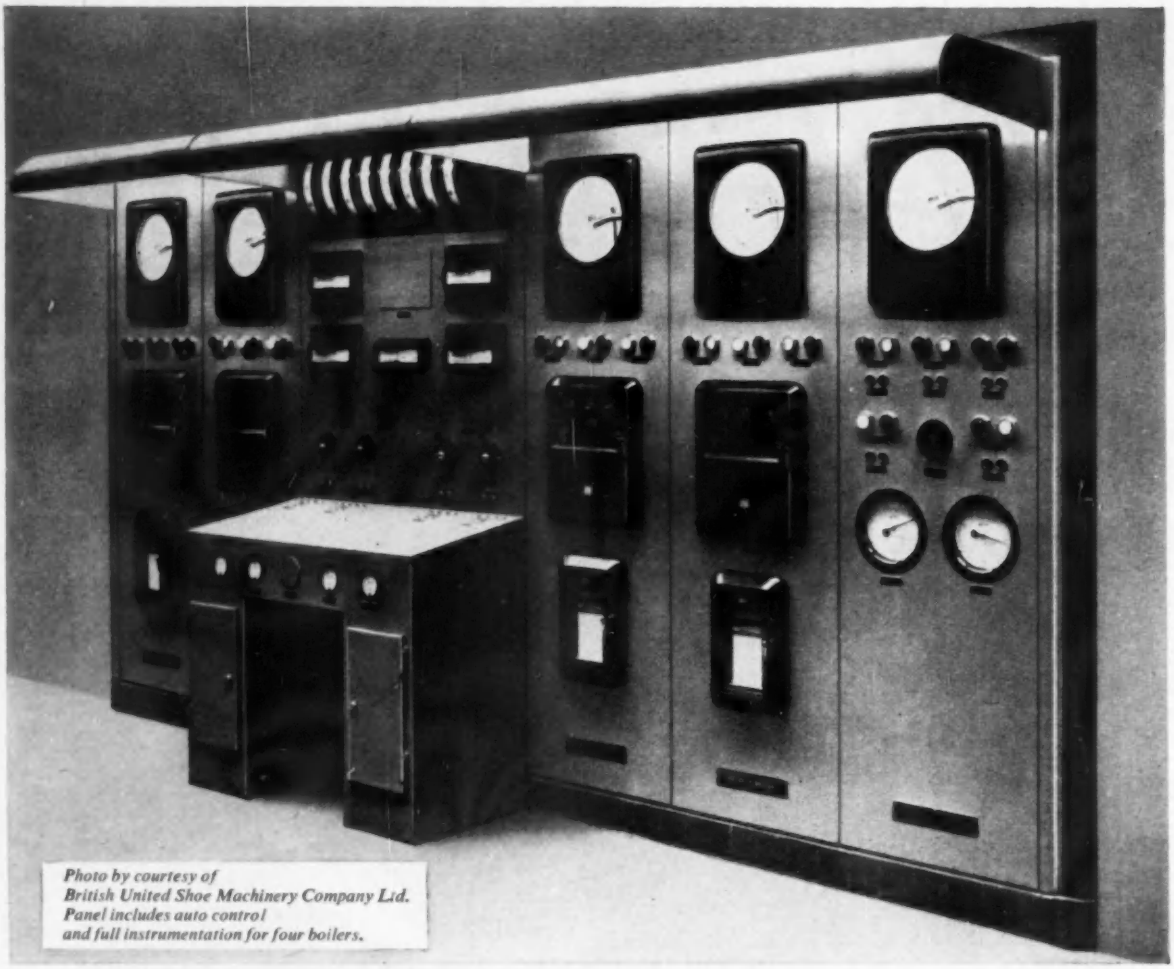


Photo by courtesy of
British United Shoe Machinery Company Ltd.
Panel includes auto control
and full instrumentation for four boilers.

INCREASE EFFICIENCY AND CUT COSTS WITH

NEW KH AUTO CONTROL FOR ALL SHELL BOILERS

This is the first automatic boiler control exclusively designed for low pressure steam and high pressure hot water shell boilers of all types. It is a simple, low cost system with numerous advantages where process steam conditions must be kept constant despite considerable variations in load. A high degree of accuracy is achieved, providing lower operating costs and ideal conditions for production processes, thereby cutting down rejects. More boilers can be supervised by a single operator. In as little as six months, the initial outlay on equipment may be recovered in fuel savings alone.

Principle of operation. As load varies, changes in steam pressure detected by the master controller are converted into electrical impulses proportional to demand. These impulses are used to adjust fuel intake by varying stoker speed, and control the air supply by means of motorised dampers. The system is all-electric and has no thermionic valves.

Many unique features. Kelvin Hughes Auto Boiler Control includes a balanced draught control and interlock system which positively prevents blowback, and a system for d.c. type stoker motors which ensures accurate fuel feed.

Backed by comprehensive pre-sales and after-sales service. Kelvin Hughes can provide facilities for survey, erection, installation, commissioning and maintenance.

Write for a leaflet giving further information

KELVIN HUGHES

SPECIALISTS IN INDUSTRIAL MEASUREMENT

KELVIN & HUGHES (INDUSTRIAL) LTD, Kelvin House, Wembley Park Drive, Wembley, Middlesex. 60-72 Kelvin Avenue, Hillington, Glasgow, SW2

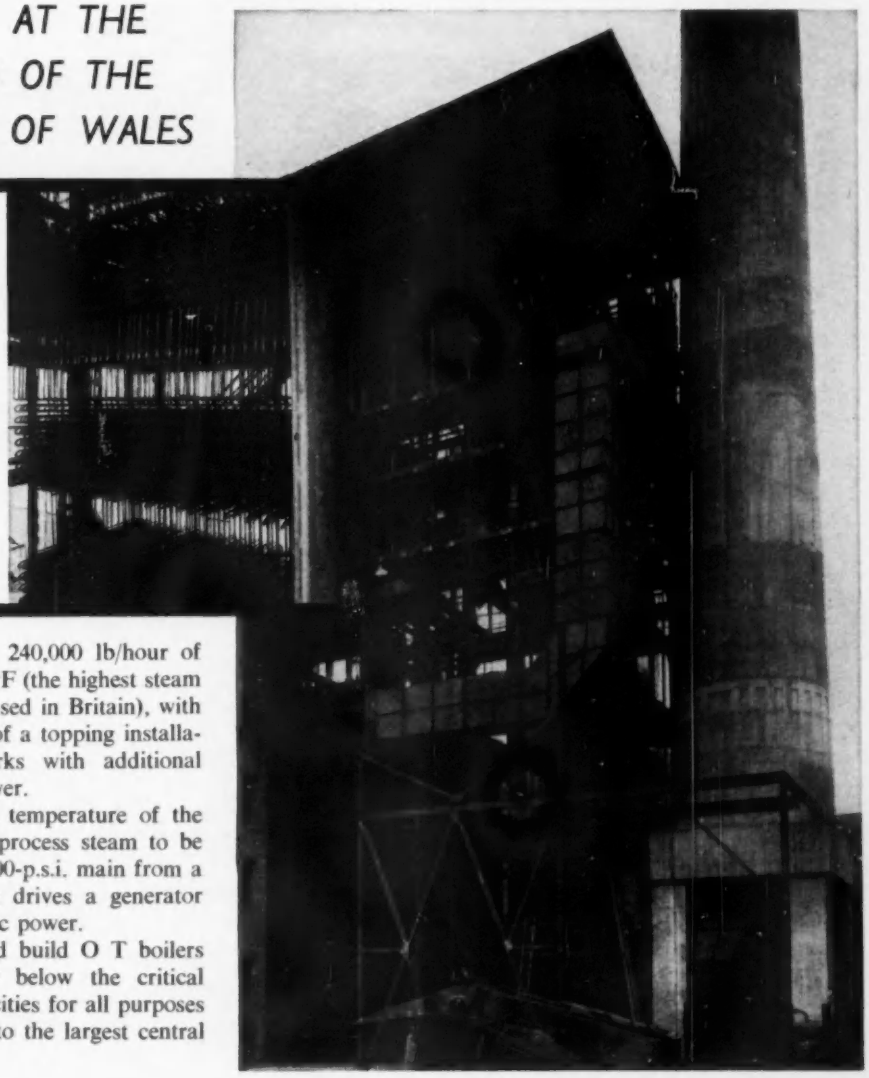
KH91

BRITAIN'S FIRST

SUPER-CRITICAL

ONCE - THROUGH FORCED - CIRCULATION BOILER

HAS BEEN BUILT AT THE MARGAM WORKS OF THE STEEL COMPANY OF WALES



Main illustration. *A general view of the boiler under construction. This is an outside job, but the operating front is housed in the turbine building.*

Inset illustration. *This close-up of the top three banks of the evaporator, taken before the chamber walls were fitted, shows the type of evaporator surface.*

This O T boiler, generating 240,000 lb/hour of steam at 3300 p.s.i. and 1060°F (the highest steam conditions yet commercially used in Britain), with reheat to 840°F, forms part of a topping installation to supply the steelworks with additional process steam and electric power.

The extra-high pressure and temperature of the initial steam supply enables process steam to be exhausted into the existing 600-p.s.i. main from a back-pressure turbine, which drives a generator producing 9500 kW of electric power.

Simon-Carves can design and build O T boilers for operation above, at or below the critical pressure, with steaming capacities for all purposes from small industrial plants to the largest central power stations.

O T FORCED-CIRCULATION BOILERS BY

Simon-Carves Ltd

SIMON ENGINEERING GROUP

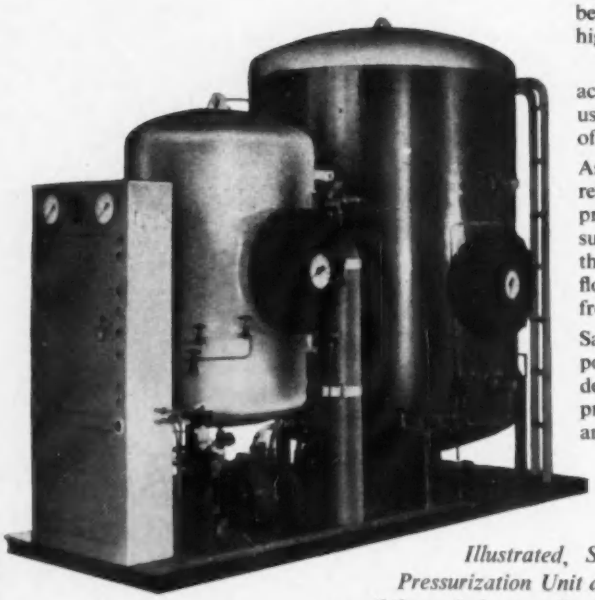
STOCKPORT, ENGLAND

and at: CALCUTTA · JOHANNESBURG · SYDNEY · TORONTO

SC208

Pressurization

FOR GREATER THERMAL EFFICIENCY IN WATER HEATING SYSTEMS



High water temperatures and greater thermal efficiency can be obtained by maintaining the water heating system at a high pressure to avoid flash-over to steam.

The Spanner Nitrogen Pressurization Unit automatically achieves this with the utmost reliability and safety, and the use of nitrogen as the compression agent prevents the ingress of air and minimises corrosion throughout the system.

As the water expands by heat, pressure is built up against the resistance of nitrogen in a high-pressure cylinder and this pressure is held at optimum level by a valve which allows surplus water to overspill into a low-pressure tank. When the water tends to contract, as a result of cooling, water flows from the pressure tank to compensate and is replaced from the spill tank by automatic pumps.

Safety devices protect the whole installation against every possible fault, and the working conditions are continuously described by a panel of coloured lights. As an additional precaution, duplicate equipment is provided for emergency and standby services.

Illustrated, Spanner hot water heater and Nitrogen Pressurization Unit demonstrates the compact design and complete accessibility of the installation. Units are designed and built to match individual needs, and further information will gladly be supplied on request.

WITH SPANNER *NITROGEN* PRESSURIZATION UNITS

SPANNER BOILERS LIMITED

WOKINGHAM ROAD · BRACKNELL · BERKSHIRE

Telegrams: Swirlyflo, Bracknell, Telex Telex: 84130

Telephone: Bracknell 1500

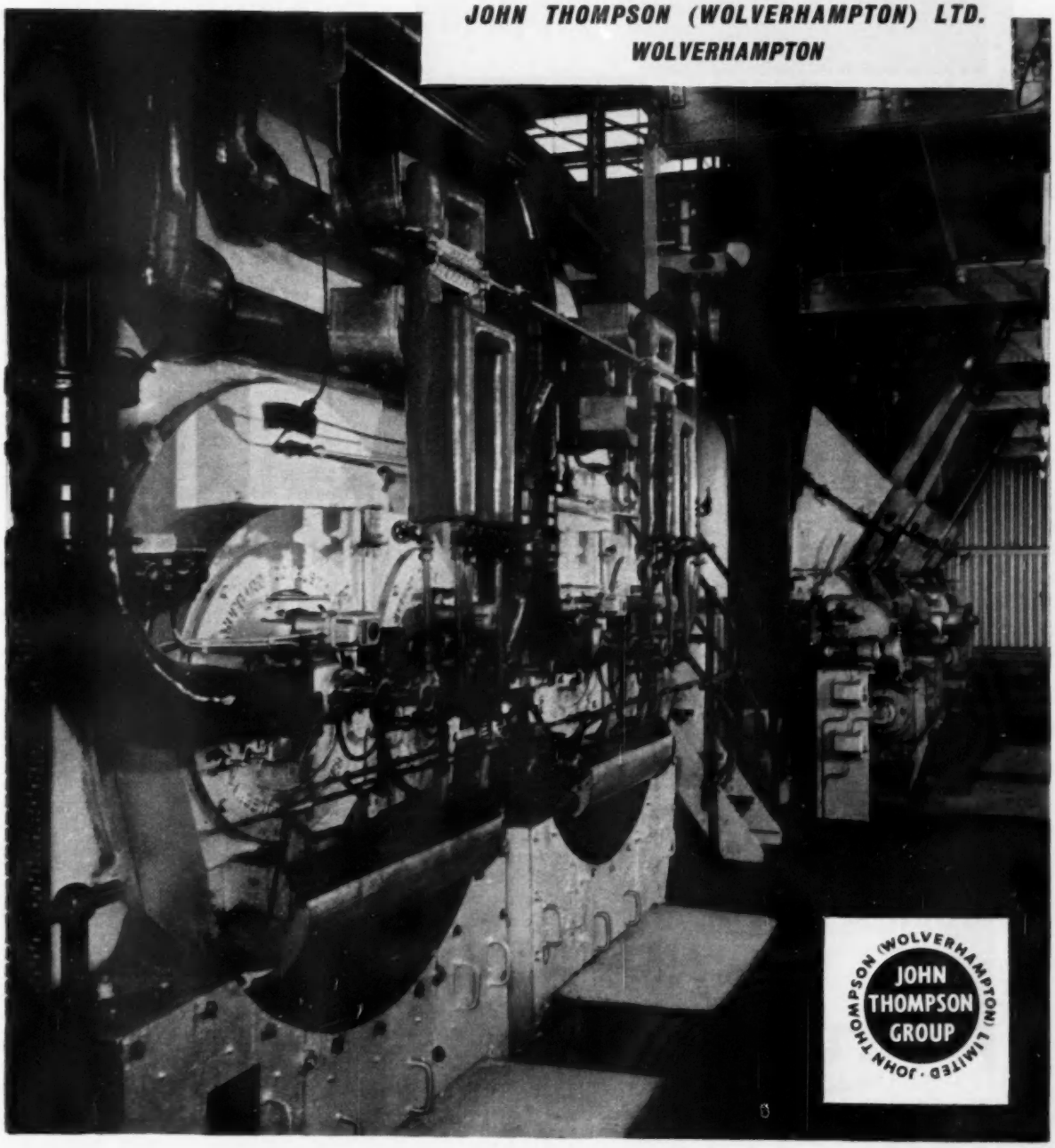
JOHN THOMPSON SUPER ECONOMIC BOILERS

and Textiles . . .

This installation at a textile factory has increased the efficiency from 65% to over 80% with a substantial saving in fuel. There are two coal-fired boilers with Thompson Triumph Chain Grate Stokers; the third boiler used as a standby for seasonal loads, is oil-fired. Water treatment by John Thompson-Kennicott Ltd., ash handling by John Thompson (Triumph Stokers) Ltd., chimneys by John Thompson (Dudley) Ltd.

Consultants—Charles F. Harris and Partners, 20 New Lane, Penwortham, Preston, Lancs.

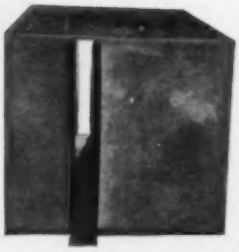
JOHN THOMPSON (WOLVERHAMPTON) LTD.
WOLVERHAMPTON



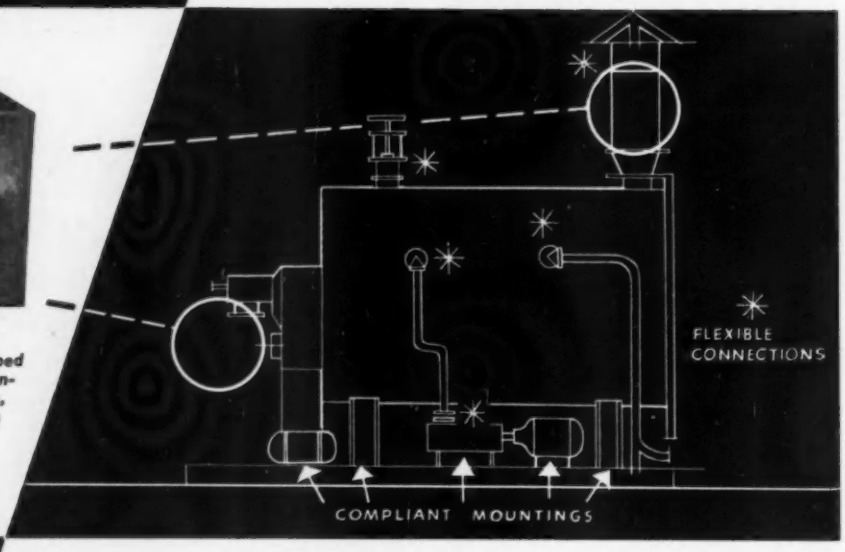
WB1/6

NOISY BOILERS

a new development in oil-fired boiler silencing



This newly developed "straight-through" silencer, of patented design, combines maximum attenuation with minimum resistance to a degree never achieved before.



Combustion noise from an Oil-fired Boiler, if allowed to pass up the flue, is not only likely to annoy the neighbours but can be transmitted most effectively around a building via the structure.

Furthermore, if permitted to escape through the air inlet into the Boiler Room itself, it will penetrate through every nearby door and window or other adjacent "weak spot," especially when amplified by reverberant conditions.

This new Silencer, which can be designed to give a reduction of 35 lb. down to 50 cycles if required, will now virtually eliminate combustion "rumble," normally predominant at the lower frequencies, at these two all-important sources.

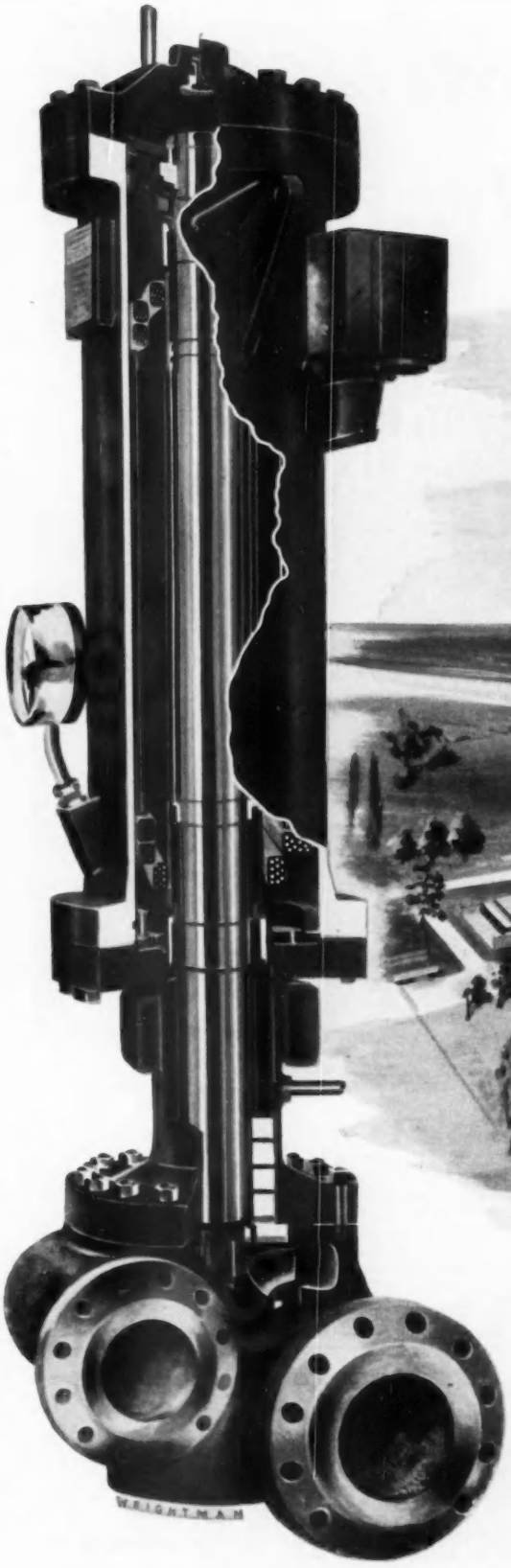
With the correct compliant mountings to boiler and ancillary mechanism and flexible connections to pipes and flue, about which we are always pleased to advise, these new Silencers, individually designed for each type of installation, will provide the final answer to the noisy Boiler problem.

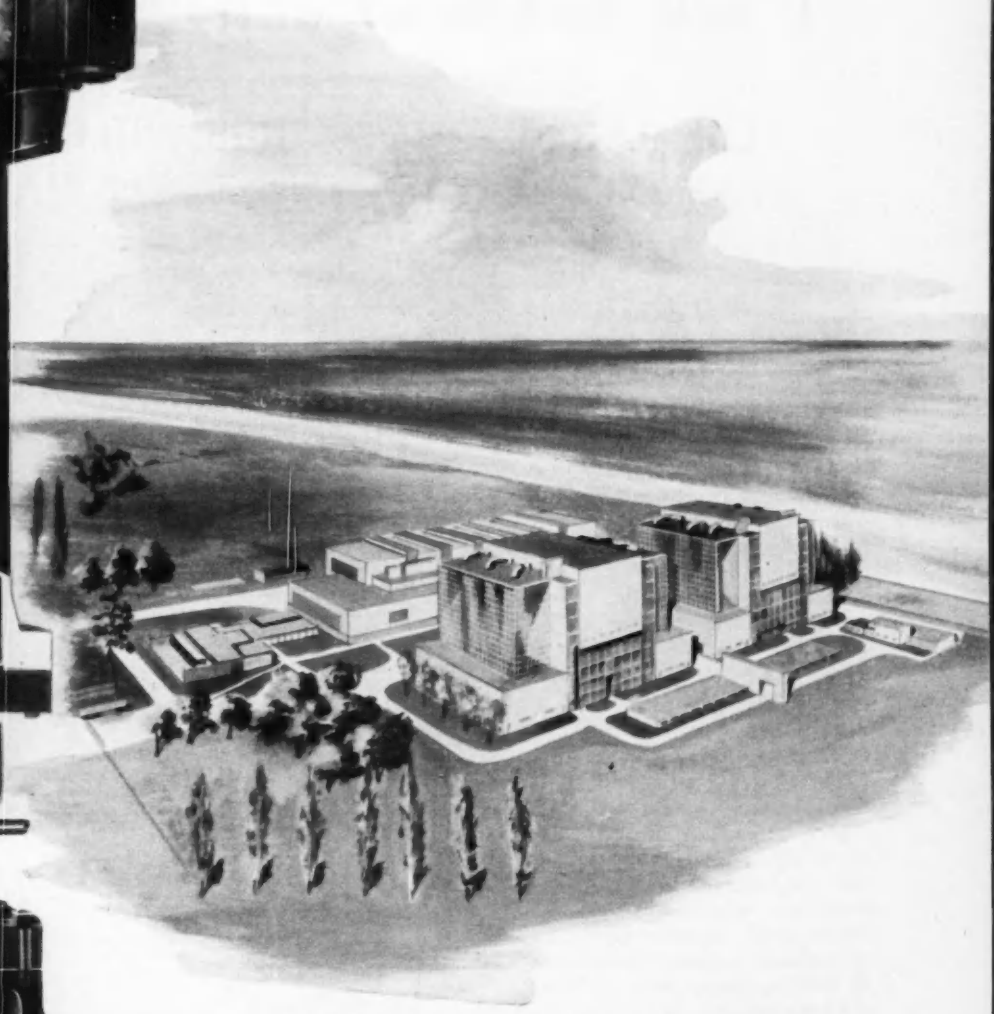
SOUND CONTROL LTD

A MEMBER OF THE HALL-THERMOTANK GROUP OF COMPANIES

Acoustic Engineers

COLNESIDE WORKS: WEST DRAYTON, MIDDLESEX. *West Drayton* 3685 (5 lines)
SCOTTISH OFFICE: 10 BOTHWELL STREET, GLASGOW C.2. *Central* 6571/2





The CEGB Nuclear Power Station at Bradwell-juxta-Mare incorporates forty-eight Hayward Tyler glandless motor pump units in the high and low pressure secondary heat exchange systems. These pumps are supplied to the order of Clarke, Chapman & Co. Ltd., member Company of the N.P.P.C. principal Contractors.

HAYWARD TYLER

& CO. LTD., LUTON, ENGLAND. LUTON 6820

LONDON OFFICE: SALISBURY HOUSE, FINSBURY CIRCUS E.C.2 NATional 9306

G.W.B. introduce the Vekos stoker

A new system of automatic coal firing

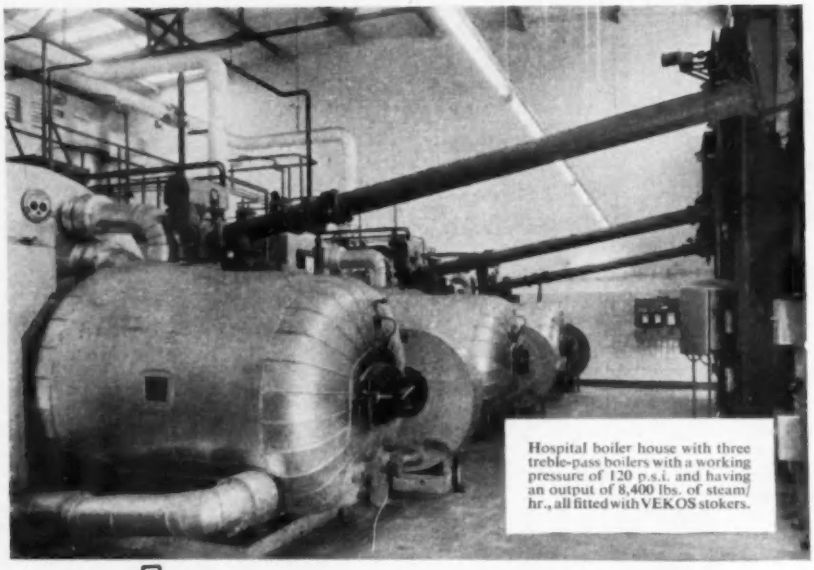
FLUE GAS CO_2 14-16% – HIGH BOILER EFFICIENCY
NO MOVING PARTS – NEGLIGIBLE MAINTENANCE

The G.W.B.-VEKOS Stoker which is based on new principles is now available. The equipment which is completely self-contained consists basically of a pre-burning unit, automatically controlled and fed, which will operate at peak efficiencies completely smoke-free, and burn bituminous fuels even of the strongly caking type. The G.W.B.-VEKOS Stoker can be fitted to almost any type of fire tube or water tube boiler, and not only increases boiler efficiency, but will add to the capacity. The usual mechanical problems associated with moving grates are non-existent, since the combustion chamber of the G.W.B.-VEKOS Stoker has no moving parts.

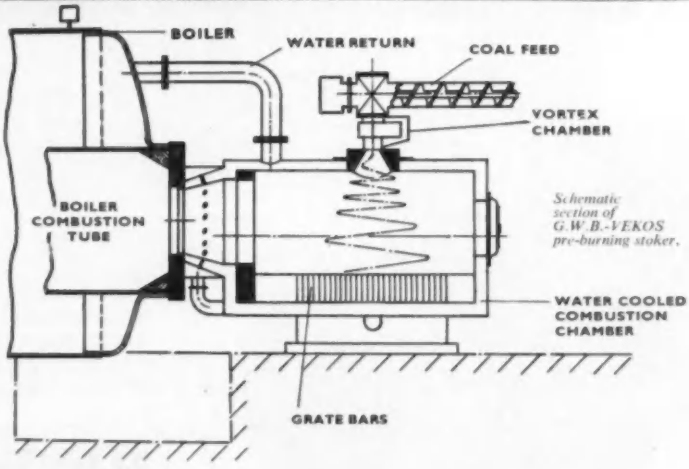
Automatic control of the fuel supply and the combustion air ensure a constant fuel/air ratio, providing an extremely high CO_2 value between 14-16%. The control also maintains correct relationship between fuel burnt and heat required from the boiler. The G.W.B.-VEKOS Stoker is a most attractive solid fuel firing proposition which provides extremely high efficiencies, while maintenance and the need for attendant labour is reduced to a minimum.

Fully descriptive leaflet VE.759 will be sent on request, and our Engineers are ready to discuss its application to your own particular installation.

The G.W.B. Vekos Stoker will be exhibited on Stand No. 28(K) at the Industrial Efficiency and Safety Exhibition.



Hospital boiler house with three treble-pass boilers with a working pressure of 120 p.s.i. and having an output of 8,400 lbs. of steam/hr., all fitted with VEKOS stokers.



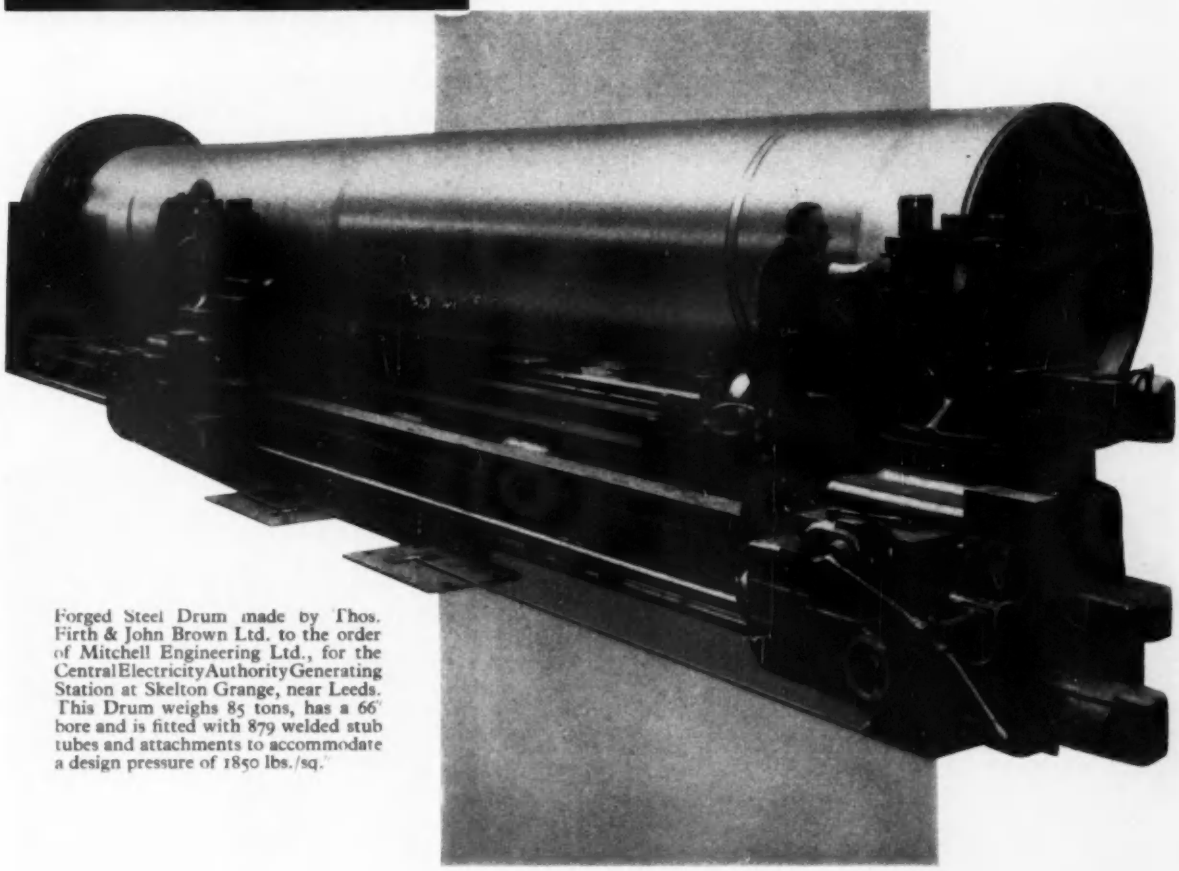
Schematic section of G.W.B.-VEKOS pre-burning stoker.

GWB **G.W.B. FURNACES LTD.** (BOILER DIVISION)

P.O. BOX 4, DUDLEY, WORCS. Tel: Dudley 55455. Grams: Gibwildbar, Dudley. Telex: 33188.
Associated with: Gibbons Bros. Ltd., and Wild-Barfield Electric Furnaces Ltd.

GWB 234

Hollow Forged Drums



Forged Steel Drum made by Thos. Firth & John Brown Ltd. to the order of Mitchell Engineering Ltd., for the Central Electricity Authority Generating Station at Skelton Grange, near Leeds. This Drum weighs 85 tons, has a 66" bore and is fitted with 879 welded stub tubes and attachments to accommodate a design pressure of 1850 lbs./sq."

by

FIRTH BROWN

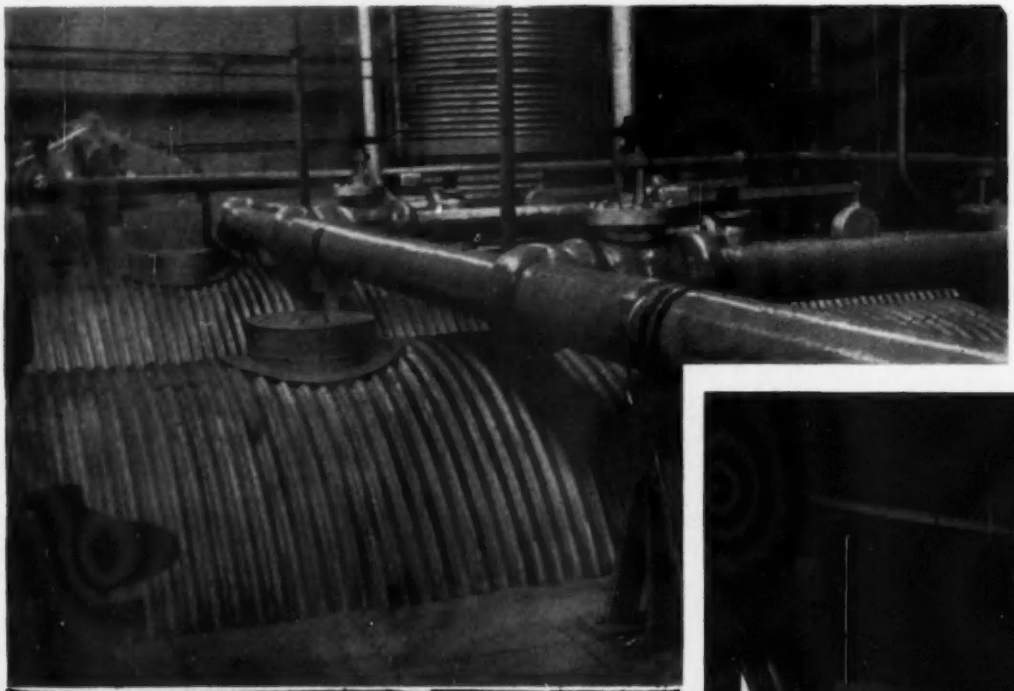
ALLOY STEELMAKERS FORGEMASTERS STEEL FOUNDERS . HEAVY ENGINEERS

THOS FIRTH & JOHN BROWN LIMITED SHEFFIELD ENGLAND

VERSIL GLASS FIBRE INSULATION IN ACTION

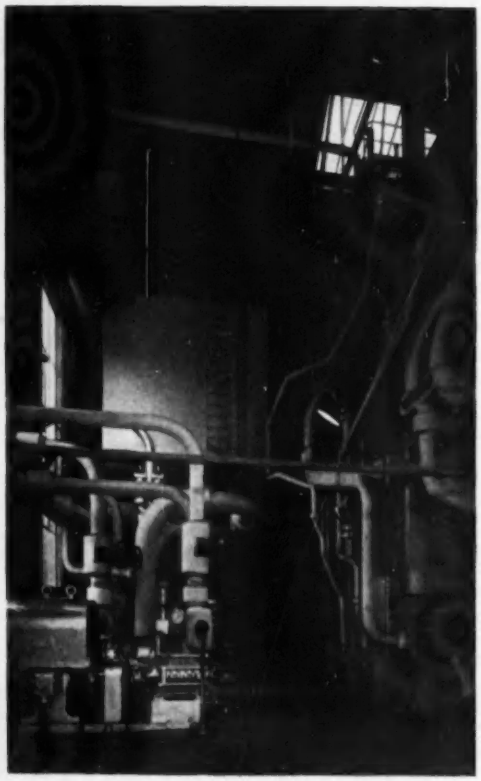
SOME RECENT SPECIFICATIONS

VERSIL is the all-purpose glass fibre insulation. It is specified for vital Nuclear power undertakings: it is used in a multitude of ways throughout the world in industrial and commercial plants. It is as effective for a few feet of steam piping as it is for the newest high-pressure steam boiler. Likewise you'll find it out of sight and out of mind in the roof space of thousands of houses, but keeping heat where it's wanted, cheaply and with certainty. There is nothing experimental about Versil glass fibre. As the photographs on these pages show; it is specified by experts. A 36-page brochure dealing with the various VERSIL materials is available on application to Versil Limited, Rayner Mills, Liversedge, Yorks. Telephone: Cleckheaton 2571/3.



Left: Versil's "Corrugated-Construction" method of insulation in the new boiler house at Fulham Hospital, London. Consulting Engineers: *E. G. Phillips Son and Partners.* **Heating Engineers:** *Z. D. Berry and Sons, Ltd.*

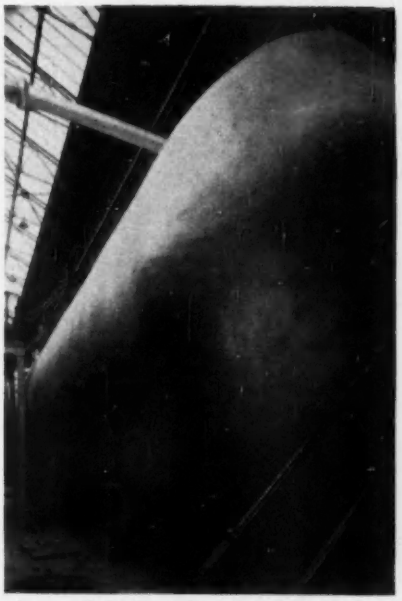
Below: A view in the Brookfoot Dyeworks of Hannam and Marshall Limited, Brighouse, Yorks, showing the Versil insulation in the pump room.



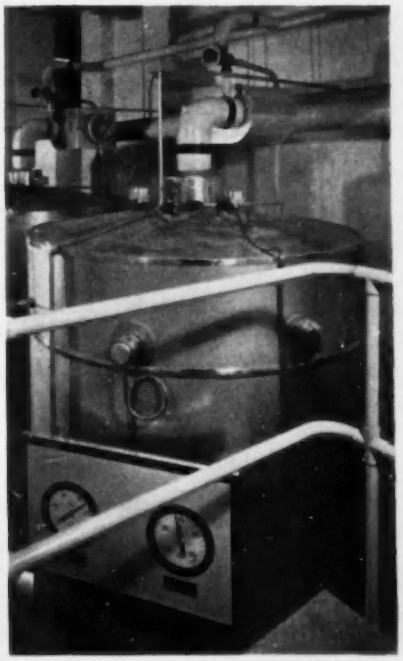
Left: The new A.E.I. building in Grosvenor Gardens, London; a photograph of the centre of the main plant room with extensive Versil insulation. Consulting Engineers: *J. Stinton Jones and Partners.* **Heating Engineers:** *Benham and Sons Limited, London.*

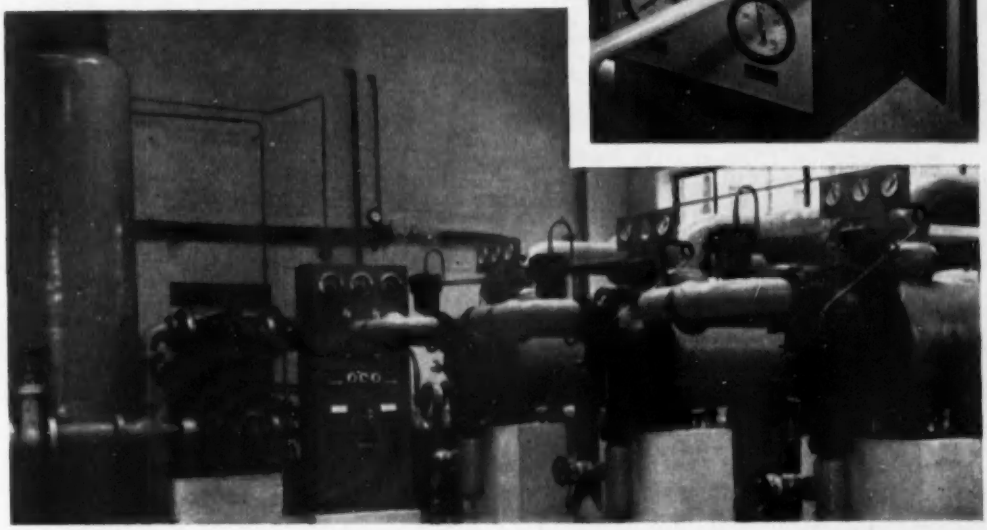
THE NEW VERSIL STRUCTURAL INSULATION

VERSIL Structural insulation, produced by a new process, is now available for insulations in accordance with the Thermal Insulation (Industrial Buildings) Act. This material is light and resilient and is very clean to use and pleasant to handle. A new Brochure "STRUCTURAL INSULATION" is available on request to VERSIL LIMITED.



Above: A Ruths Steam Accumulator in the works of Hannam and Marshall Limited, Brighouse, with Versil insulation. It is 72' long × 12' diameter.





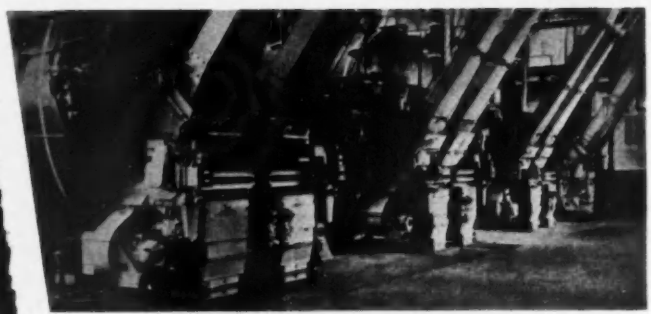
Right (centre): Another view in the new A.E.I. building, Grosvenor Gardens, London, showing the south end of the main plant room.

Right (bottom): The Fulham Hospital, London, for which Versil glass fibre insulation was specified for the boiler house and calorifier room. The two photographs taken in Fulham Hospital are reproduced by courtesy of "Hospital and Health Management."

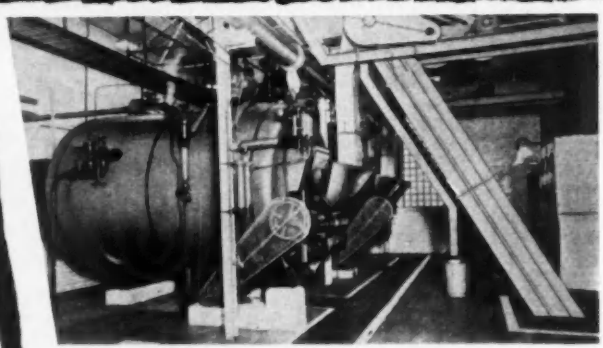
Is your problem smoke prevention?

Clearly BENNIS have the answer –in fact **two** answers!

With the CHAIN GRATE and "LOW RAM" Stokers for the firing of shell type and small water tube boilers Bennis offer two machines which give not only freedom from legislative action but a new economy. For smokeless combustion, higher thermal efficiency and fuel economy with maintenance costs reduced to a minimum, the answer is clearly BENNIS.



Bennis Chain Grate Stokers fitted to Economic boilers.



"Low Ram" Stokers fitted to Ruston & Hornsby Horizontal "Thermax" Economic boilers.

We can also supply Oil Fuel Burners and Auxiliary equipment with complete erection, pipework and storage tanks.

BENNIS
COMBUSTION LIMITED

LITTLE HULTON, WALKDEN, MANCHESTER
Telephone: WALkden 3213/4/5

ONE OF THE HODGKINSON GROUP OF COMPANIES

LONDON OFFICE: Brettenham House, Lancaster Place, Strand, W.C.2.
Telephone: COVent Garden 1512

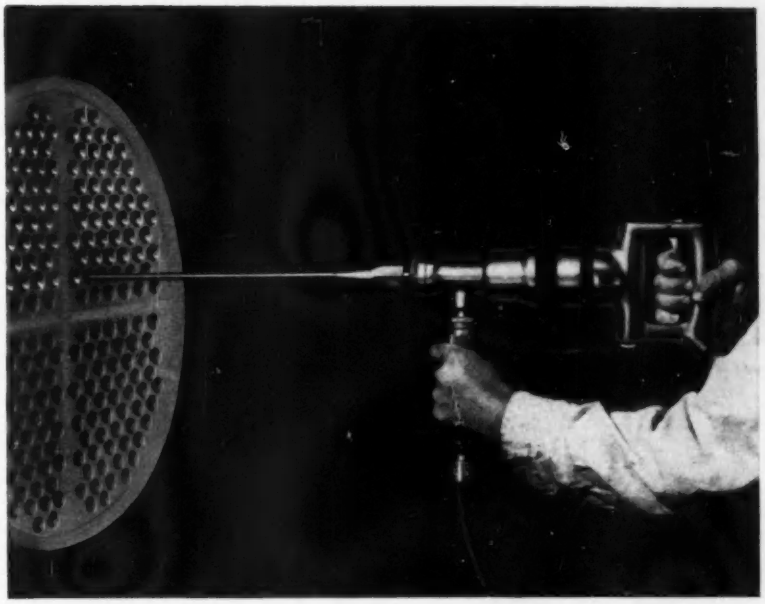
Whatever your tube maintenance problems AIRETOOL equipment will solve them FASTER... EASIER... AT LESS COST

Write, telegraph or telephone for complete information

ENGLAND SALES OFFICE
8 Woodland Way
Morden, Surrey, England
Telephone: Liberty 7039
G. B. Herbert
Sales Representative

EUROPEAN FACTORY AND WAREHOUSE
18 Industriweg
Vlaardingen, The Netherlands
Telephone: Vlaardingen 5254

CANADIAN PLANT
37 Spalding Drive
Brantford, Ontario



One man handles this powerful Airetool tube cleaner...without a rig

There's no other tool like this Airetool Model CC-475 heat exchanger and condenser tube cleaner. It weighs just 10 lbs. One man handles it easily — without a supporting rig. Yet, it's powerful enough to clean all severely clogged tubes up to 1″ diameter. Built-in flushing system washes away debris, cools drill head — keeps work moving at a fast pace.

You get this same time and cost-saving performance from Airetool straight tube cleaners and pneumatic, as well as electric tube expansion control systems. Write for Bulletin 66. *The Airetool Mfg. Co., Springfield, Ohio*

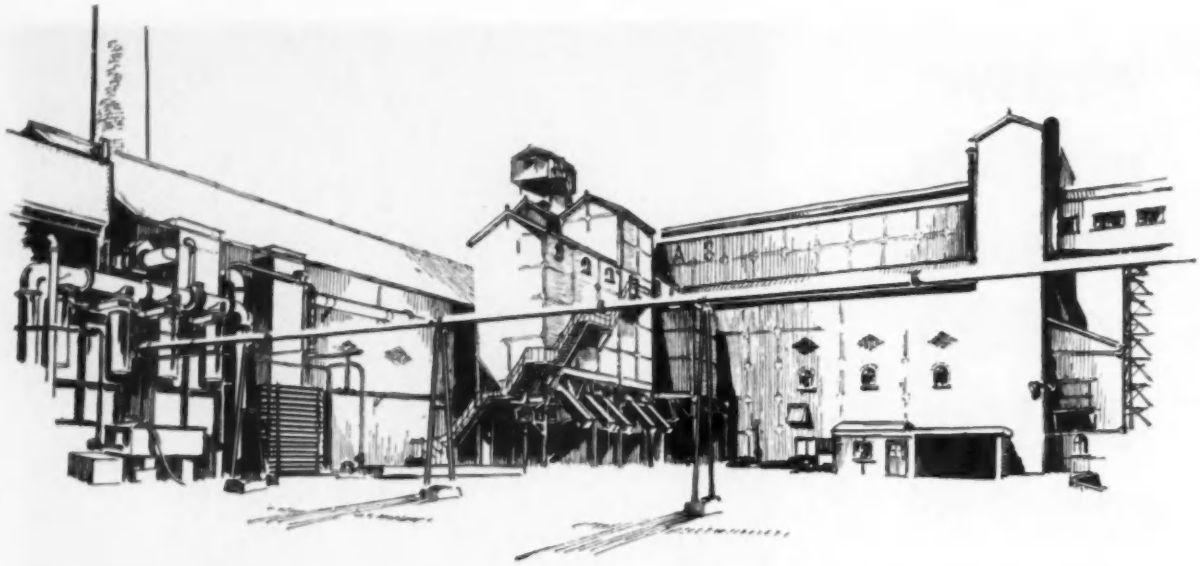
BRANCH OFFICES:
New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge.

REPRESENTATIVES
in principal cities of U.S.A., Canada, Mexico, South America, England, Europe, Puerto Rico, Italy, Japan, Hawaii.

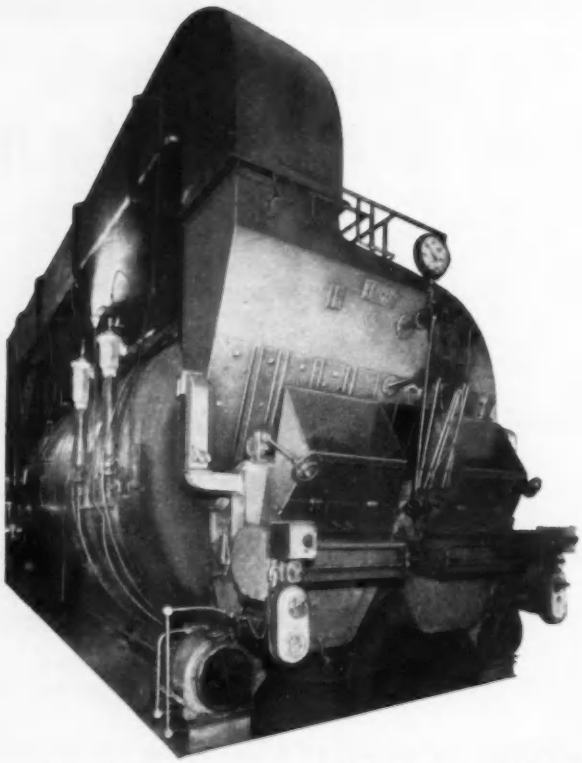
EUROPEAN PLANT:
Vlaardingen, The Netherlands

CANADIAN PLANT:
Brantford, Ontario

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO



Artist's impression of Camberley Gas Works



The 11 ft. 6 in. diameter × 16 ft. 0 in. long Paxman double pass Economic boiler complete with induced draught fan installed at Camberley Gas Works, Surrey.

CAMBERLEY GAS WORKS

Camberley Gas Works provides domestic gas to the householders and industries of the 21,000 inhabitants of this Surrey town. For the general gas works service a boiler having economical and reliable characteristics was required to produce steam at the rate of 9,300 lb./hr. and at a working pressure of 150 lb./sq. in.

Davey, Paxman & Co. Ltd., with one hundred years' experience in boiler manufacture, supplied one of their Economic, double pass medium velocity boilers adapted for firing with coke breeze.

Paxman Economic boilers are supplied in thirty-six sizes with evaporation ratings from 2,000 to 26,250 lb./hr. from and at 212° F. Diameters range from 5 ft. 6 in. minimum to 13 ft. 6 in. maximum. Of the thirty-six sizes available, eighteen are double pass; the remainder are treble pass. All sizes can be supplied as high or medium velocity units and are suitable both for oil or coal firing.

For full details please write for Publication No. 1515 Paxman Boilers.

DAVEY, PAXMAN & CO. LTD. · COLCHESTER · ENGLAND

Telephone · Colchester 5151 · Telegrams · Paxman · Colchester · Telex · Telex No. 1875

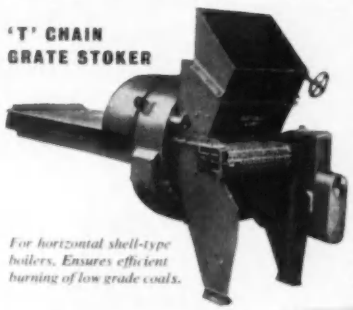
ALSO MANUFACTURERS OF ENGINES, ROTARY VACUUM FILTERS AND HEAVY FABRICATION WORK

B.68

RILEY ROBOT

Hopper feed. Suitable for sectional boilers in domestic hot water or space heating systems—and vertical boilers for steam-raising.

'T' CHAIN GRATE STOKER

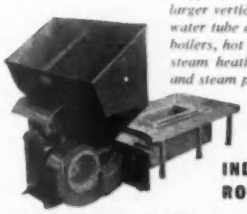


For horizontal shell-type boilers. Ensures efficient burning of low grade coals.

DIREKTO

Bunker feed. For sectional boilers in domestic hot water and space heating systems. Also for vertical boilers used in steam-raising. Feeds direct from bunker to boiler below floor level.

Hopper feed. For the larger vertical boilers, water tube and locomotive boilers, hot water and steam heating systems and steam processes.



INDUSTRIAL ROBOT

CLASS 'B'

Hopper feed. For Cornish, Lancashire and Economic boilers. Specially designed with grate to fit into circular furnace flues.

IT IS AN OFFENCE TO EMIT DARK SMOKE

Under the Clean Air Act it is now an offence to emit dark smoke. The problem of ensuring smokeless combustion within the meaning of the Act without costly conversions can be solved by the installation of Riley Chain Grate or Under-feed Mechanical Stokers. Write for full technical information.

all these RILEY STOKERS provide smokeless combustion from small bituminous coal

Full comprehensive after-sales service is available from service depots at Birmingham, Bristol, Glasgow, Leeds, Manchester, Melton Mowbray and Newcastle-on-Tyne.

RILEY (IC) PRODUCTS LIMITED

Mechanical Stokers · Syntron Electric Vibratory Equipment

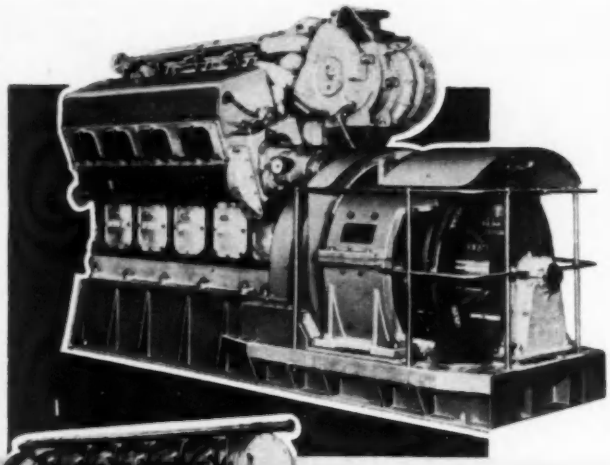
A member of the International Combustion Organisation

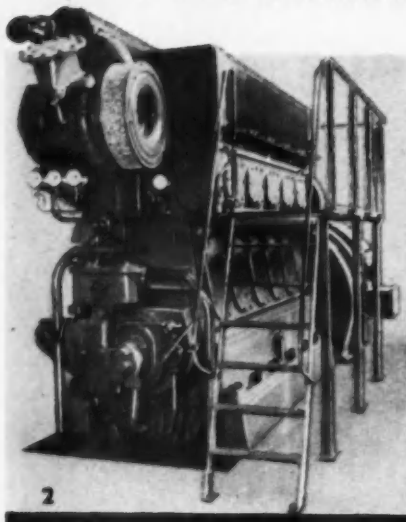
NINETEEN WOBURN PLACE · LONDON WC1 · TERMINUS 2622

TGA R66

ALLEN
DIESEL
POWER PLANT

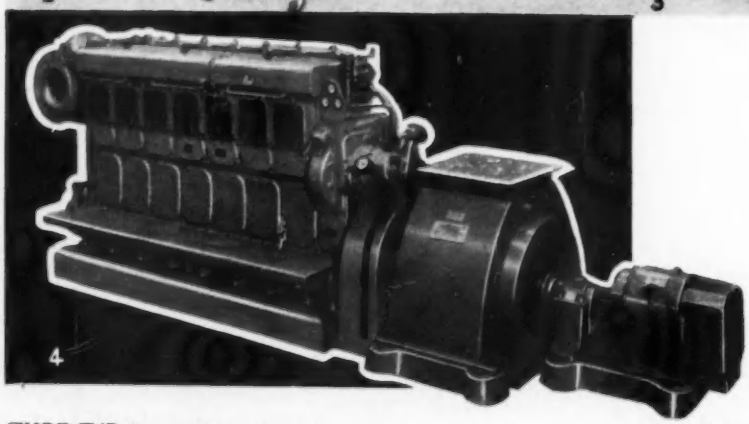
TWO-STROKE and FOUR-STROKE ENGINES and complete A.C. and D.C. GENERATING SETS





2

3



4

The engine generating sets illustrated are:-

(1) 8-cylinder, 640-b.h.p., 750-r.p.m., type VBS12 vee-form pressure-charged engine and 440-kW Allen d.c. generator.

(2) 5-cylinder, 660-b.h.p., 500-r.p.m., type BS37-D pressure-charged engine and 450-kW Allen d.c. generator.

(3) 6-cylinder, 780-b.h.p., 375-r.p.m., type T47 engine and 540-kW Allen alternator.

(4) 7-cylinder, 469-b.h.p., 600-r.p.m., type BS12 pressure-charged engine and 322-kW Allen alternator.

TYPE T47 (normally aspirated)
Two-stroke: 312 to 1040 b.h.p. (216 to 720 kW).
Speeds: 300-375 r.p.m.
(Built under licence from Harland & Wolff Ltd.)

TYPE S37-D (normally aspirated) and

TYPE BS37-D (pressure charged)
Four-stroke: 228 to 1056 b.h.p. (156 to 720 kW).
Speeds: 428-500 r.p.m.

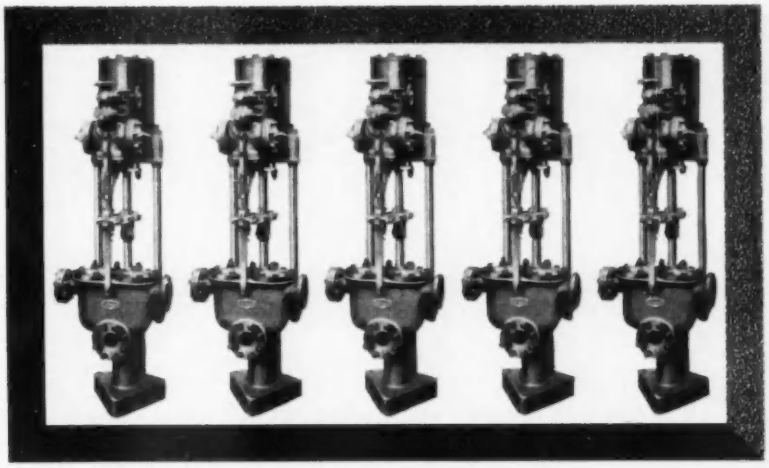
TYPE S12 (normally aspirated) and
TYPE BS12 (pressure charged)
Four-stroke: 112 to 640 b.h.p. (75 to 440 kW).
Speeds: 500-750 r.p.m.

TYPE VS12 (normally aspirated) and
TYPE VBS12 (pressure charged)
Four-stroke vee form: 225 to 1068 b.h.p. (155 to 732 kW).
Speeds: 500-750 r.p.m.

All engines may be run at lower speeds with reduced outputs and arranged for remote starting and stopping or completely automatic control.

W. H. ALLEN SONS & Co. LTD

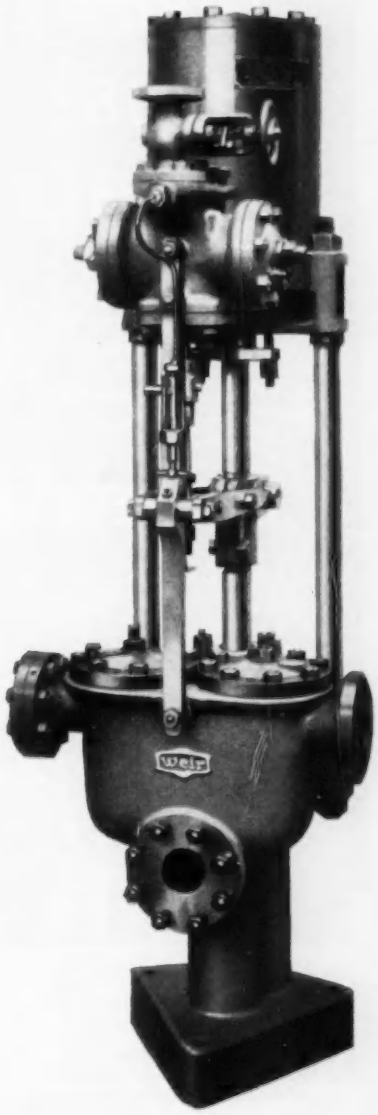
BEDFORD ■ ENGLAND



hundreds of thousands
all over the world

Weir

Direct-Acting
BOILER FEED PUMPS



the simplest, most foolproof and reliable pump ever devised—proved in over 75 years' service on land and at sea

Other duties, too—

Weir Direct-Acting Pumps are also used extensively for duties other than boiler feeding—oil fuel pressure and transfer, handling oils, sludges, effluents, etc., and general services.

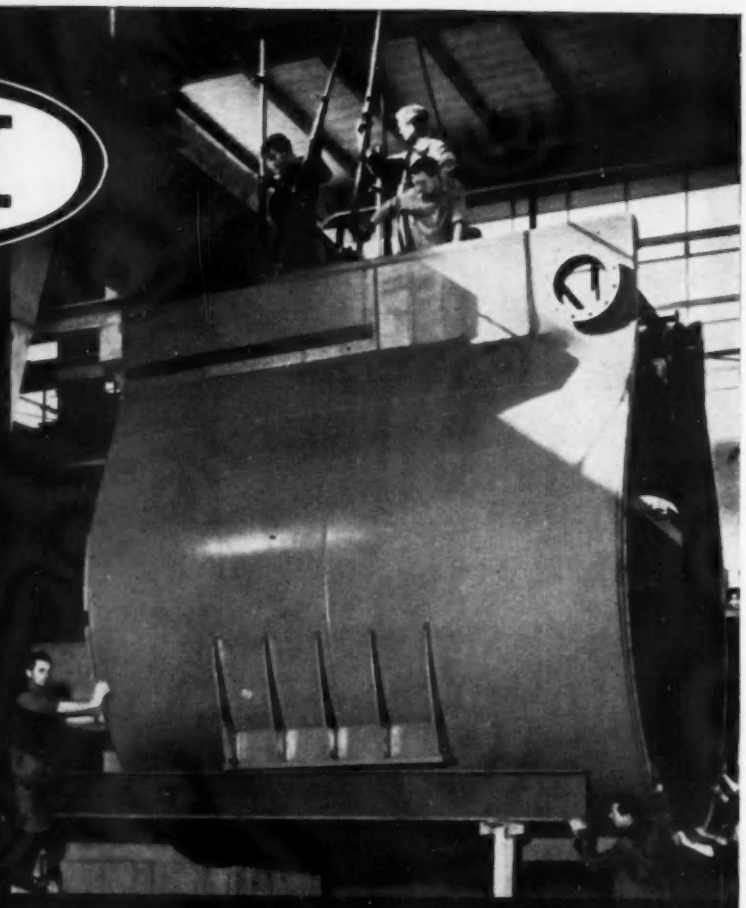
Your enquiries are invited, giving specific characteristics of liquid to be handled.

Weir

G. & J. WEIR LTD., CATHCART, GLASGOW, S.4

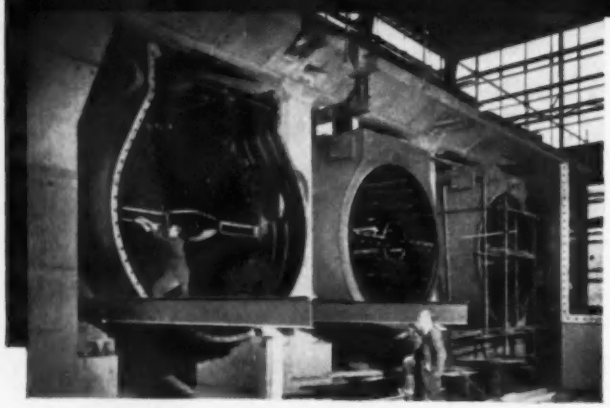
AEI

COMPLETE TURBINE-HOUSE EQUIPMENT



One unit of a three-shell surface condenser being placed in position at Berkeley, the commercial nuclear power station now under construction in Gloucestershire by the A.E.I.—John Thompson Nuclear Energy Company.

FOR BERKELEY NUCLEAR POWER STATION



A general view of three condenser shells in position at Berkeley.

The entire turbine-house heat exchange equipment for the new power station at Berkeley is being supplied by the A.E.I. Turbine-Generator Division, and manufactured at their factory at Germiston Glasgow.

Four three-shell main condensers — one for each of the four 83 MW mixed-pressure steam turbine-generators also being supplied by A.E.I.

Two-stage feedwater heating equipment for each turbine-generator.

Two 'dumped' steam condensers to handle surplus steam generated when commissioning the reactors, or in the event of a sudden shut down.

Other equipment in manufacture includes the steam jet air ejectors, water/water heat exchangers for the generator cooling circuit and general gas circulator service, oil coolers and generator hydrogen cooler units.

ASSOCIATED ELECTRICAL INDUSTRIES LTD.

TURBINE-GENERATOR DIVISION

WORKS AT MANCHESTER AND RUGBY, ENGLAND. GLASGOW, SCOTLAND. LARNE, NORTHERN IRELAND.

BA 804

Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

NOVEMBER 1959

VOLUME 74. No. 11

Principal Contents

	Page
EDITORIAL NOTE	333
POINTS AND POINTERS	334
THE EFFECT OF NON-UNIFORM HEAT DISTRIBUTION ON STEAM GENERATION IN TUBES	336
BRITAIN'S MOST POWERFUL TURBO-GENERATOR ON LOAD	338
DEVELOPMENT OF BOILER DESIGN BY SULZER BROTHERS LIMITED	340
LARGE OIL REFINERY IN EIRE	245
NORTHERN OUTFALL WORKS OF L.C.C.	348
PROGRESS AT BRADWELL	351
RECENT EQUIPMENT AND ACCESSORIES	353
OVERSEAS STEAM ENGINEERING PRACTICE	357
LATEST POWER PLANT PATENTS	359
NOTES—PERSONAL AND INDUSTRIAL	364

The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable

Published monthly by

ENGINEERING REVIEW PUBLISHING CO. LTD.
19-20, NOEL STREET, LONDON, W.1

Annual Subscription Rate, 40s., including postage.

Telephone
Gerrard 8811

Telegrams
"Farsighted, Wesdo London"

All present and Correct...

AT BRITAIN'S HIGHEST EFFICIENCY POWER STATION

Right: Photograph showing megawattmeters at Castle Donington in June 1959, registering unit outputs of approximately 102, 100, 102, 99, 98, 99 megawatts.

102 100 102 99 98 99

MEGAWATTS

WITH all its six 830,000 lb./hr. Babcock Radiant boilers on full load by June 1959, Castle Donington power station (C.E.G.B. East Midlands Division) was the first British station with 100 MW boiler/turbine units to come into full operation.

This station has also topped the efficiency table with an overall thermal efficiency of 32·9% and monthly averages reaching 33·33%.

The boilers have put up a first-class performance, available figures showing individual units operating at load factors over 90% with availabilities of the same order.

The 960 tons/hr. coal handling plant, the ash and dust handling system and the boiler control equipment for this outstanding station were also supplied by the Babcock organization.

BABCOCK
STEAM-RAISING PLANT

BABCOCK & WILCOX LTD, BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W.1

Engineering and BOILER HOUSE REVIEW

NOVEMBER 1959

VOLUME 74 No. 11

REVISED PLAN FOR COAL

WHEN the National Coal Board issued the general guide to its investment policy in October, 1950, under the title "Plan for Coal," there was every indication that there would be an increasing demand for coal for an appreciable number of years. It was emphasised when the original plans were announced, that the programme was flexible, and would have to be revised from time to time in the light of current trends. At that time, and indeed, up to little more than two years ago, few people could have visualised that a considerable amount of replanning would be necessary to conform with a declining, instead of an increasing, demand. In fact, there even appeared to be evidence that the increases planned for coal production by 1965 would not fully satisfy the demand. The Ridley Committee's Report, published in 1952, estimated that inland demand would rise to 230 million tons by 1962, and that the export demand would then be 25-35 million tons per annum.

Towards the end of 1957, however, prospects of a considerable change in the whole situation became evident, when a moderate industrial recession, and a rapidly-growing use of oil began to suggest that the continuous increase in coal production provided for in the overall plans was no longer necessary. During the past three years this decline in the demand for coal has continued, with the result that not only Britain, but all the coal-producing countries of Western Europe are faced with an actual or potential excess of capacity.

To meet the changed conditions, the National Coal Board has made comprehensive revisions to its programme, details of which are given in a recently issued publication entitled "Revised Plan for Coal." This document, in addition to outlining the financial aspect of the plans (including the costs of various ancillary activities), surveys the changes affecting the coal industry since the issue of the original "Plan for Coal," and the major revisions recommended and included in the subsequent publication, "Investing in Coal," which was published in April, 1956, and in which the general reconstruction plans were broadly unchanged, although a sharp rise in the general price level meant that much more money would be needed to carry the plan through.

It is calculated that, based upon 1955 prices, a saving of £175 million will be made on the originally estimated capital expenditure for the period 1956-65, and that over the next six years £440 million is to be spent on 168 major colliery development schemes now in progress, on about ninety new schemes and on various minor schemes at collieries within the nine divisions of the Board. The schemes in progress will have cost £245 million to the end of 1959, and approximately £200 million will be spent on them in 1960-65. Approximately £67 million will be spent during the period on the ninety new schemes, leaving about £23 million to be spent after 1965 to complete them. Expenditure on the minor schemes, which include mechanisation schemes, replacements, and reconstructions costing less than £250,000, will amount to £173 million in 1960-65.

Fuller details are given of the previously announced scheme for closing some 240 uneconomic collieries, and reducing manpower by up to 11 per cent. In the period 1960-65 it is expected that 120 collieries will be closed because their reserves are wholly exhausted or virtually exhausted, about thirty collieries will merge their operational activities with others, and finally, some collieries will have to be closed because of the poor quality of their coal and, or alternatively, because their costs of production are so excessive that the coal can only be sold at a heavy loss. There is, however, a certain degree of flexibility as provided in the plan by a decision to close not fewer than thirty-five, or more than seventy uneconomic pits, according to the demand which will exist in 1965. It is estimated that the plan will result in an annual coal production of 200-215 million tons in 1965, with a productivity of 30 to 31 cwt. per man shift as compared with 25.3 cwt. last year. Reconstruction will be carried forward in general conformity with the programme outlined in "Plan for Coal" (1950), and by 1965 approximately 80 per cent. of the output will be coming from reconstructed or new collieries.

Points and Pointers

B.C.U.R.A. EIGHTH COAL SCIENCE LECTURE

The Eighth Coal Science Lecture, entitled "Coal: A Colloid and a Chemical," was delivered by Sir Eric Rideal, F.R.S., Fellow of Trinity Hall, Cambridge, on October 14th, at the Institution of Civil Engineers. The lecture embodied the thoughts of a distinguished chemist, having life-long experience of surface and colloidal phenomena, on the results of coal research and their possible fields of application. Sir Eric recalled the stress laid on the colloidal aspects of coal by the late Dr. D. H. Bangham, and said that he regarded this lecture as an opportunity for paying tribute to his memory. He expressed surprise at the underlying chemical similarity of coals despite their differences in origin, and pointed out that at some stage in their history, the colloidal portions of coal must have undergone phase inversion, from an aqueous emulsion to a "grease" in which the continuous phase is a solid. The progressive aromatisation during maturing seemed to imply intramolecular mobility, at least in the earlier stages. The lecturer then discussed the structure of coal on an atomic scale, and the porosity that partly resulted from the irregular arrangement of molecules. The porosity occurred in three distinct size ranges, the smallest of which contributed most of the internal surface. As a result of this, the Kelvin equation for capillary size distribution was not applicable to the most important part of the pore structure. He discussed the possibility of blocking these very small passages. Sir Eric went on to consider the dimensional changes that occur when vapours are adsorbed on the internal surface of coals and charcoals. He discussed at some length the concept of swelling pressure, the thermodynamics of the phenomenon, and its relation to the structure of the material. It was suggested that in the low rank coals, oxygen-containing groups might tend to anchor sorbate molecules and thus form nuclei for hydrogen-bonded islands of two-dimensional liquid. The lecturer then suggested that the ready elimination of hydrogen from coal by treatment with 50 per cent. aqueous sulphuric acid, and other examples of fairly complete chemical reaction, supported the gel theory of coal structure. Turning to the combustion and gasification of coals, Sir Eric noted that the greater part of the heat of combustion of carbon was released subsequent to formation of carbon monoxide, and that this effect was fortunate, since gases were more conveniently handled. Smokeless combustion might be promoted either by enlarging the pore structure or by dehydrogenating the coal. Following a discussion on the relative ease of dispersing the coal gel, e.g., in solvents, and the relation of this to the preparation of coal/oil fuels, the lecturer then considered coal preparation by flotation, in the light of surface wetting considerations. Oxidation made the coal more hydrophilic, and he suggested that a study of the changes in wetting angle during chemical reduction followed by oxidation might lead to useful results. A brief reference was then made to complete gasification of coal and the study of slags, the possibility of using surplus coal in conjunction with oil as colloidal fuel, and the possibility of reducing the cost of pulverised fuel. An interesting final section was devoted to the possibility of making chemicals directly from coal; it was suggested that the advantage of basing chemical industry more fully on indigenous raw materials might justify special methods of costing coal for this purpose.

POSSIBILITY OF C.E.G.B. CONSTRUCTING 300-MW AGR

At the Press conference following publication of the first annual report of the Central Electricity Generating Board, and to which we made reference in the October issue of this journal, Sir Christopher Hinton, chairman of the Board, said that a team was studying the possibility of constructing a prototype 300-MW advanced gas-cooled reactor (AGR). The decision to proceed very much depended on the Atomic Energy Authority's final decision on fuel element canning material. With the 300-MW output, it appears that the cladding would possibly be stainless steel, unless, of course, experience obtained with the prototype unit being built at Windscale showed that beryllium was necessary. Should this be the case, some lengthy delay would be inevitable, until full operational experience was available. Provided stainless steel is satisfactory, the earliest date at which the Board could have the reactor in commission is 1966. It appears that industrial concerns have already been approached, and have indicated their readiness to submit designs. It may be remembered that preliminary work on the prototype AGR began at Windscale in October, 1958. The programme of irradiation experiments has been proceeding for some considerable time, and these experiments are now yielding information upon the behaviour of beryllium-canned uranium oxide fuel, and upon measures to minimise the loss of moderator graphite by the conversion to CO in the CO_2-graphite reaction. The results of this work will thus be available in time to allow for any necessary modifications to be incorporated in the prototype and its fuel.

ATOMIC ENERGY EXHIBITION AT PROVINCIAL CITIES

An exhibition on Britain's nuclear power programme and the uses of radioisotopes in industry, medicine and research, presented by the U.K.A.E.A., is to visit a number of provincial cities. It opened first at Sheffield on November 6th, for nine days. Other cities to be visited in the near future, where arrangements have already been made for the exhibiton's presentation, are Bradford and Bristol. A special feature of the exhibition is a working model built by the Authority to demonstrate the operation of a nuclear reactor. It consists of a large "cut-away" model of a Calder Hall reactor and its associated turbo-alternators; the model being equipped with a panel from

which the reactor controls can be operated. Visitors can thus see how the nuclear chain reaction inside the atomic pile is controlled by the insertion or withdrawal of neutron-absorbing rods; how carbon-dioxide gas is circulated through the reactor to remove the heat given off by the uranium fuel elements, transferring it to the heat-exchangers to generate the steam supply for the turbines which drive the generators; and how heat and, in turn, steam and power output, is controlled by manipulation of the control rods combined with adjustment of the carbon-dioxide blower speed. This model forms part of the section illustrating the development of nuclear energy for electricity generation. The section shows the advances made to implement Britain's declared programme of providing 5,000 to 6,000-MW of electricity from nuclear sources by 1966, the progress in design of reactor fuel elements, and the Authority's development work towards lowering the capital costs of future nuclear reactors. The other section of the exhibition, featuring radioisotopes, explains how these are produced, processed and packed, and demonstrates the principles of their use. Examples will be shown of radioisotope applications in medical diagnosis and in the treatment of malignant disease; in industrial processes, where radioactive sources are widely used for thickness gauges, radiography and production control; and in research, such as the study of tidal movements in estuaries and investigations into the biological results of insecticides. The exhibition in Sheffield was presented with the full co-operation of Sheffield Corporation. Sheffield University Authorities also collaborated with the Authority in the organisation of a series of public lectures on nuclear subjects which were associated with the exhibition.

THE INSTITUTION OF PLANT ENGINEERS The Education Committee of The Institution of Plant Engineers announced recently that the next of their comprehensive refresher Courses for senior works and plant engineers is to be held this winter at Leeds University. Sponsored by the Pro-Chancellor of the University, this is the latest of a series of major courses at various centres in Britain, all of which have set up enrolment records for engineering refresher courses. It comprises 18 weekly lectures on Thursday evenings, and the first lecture was given on Thursday, October 29th. The syllabus has been drawn up to cover an extensive range of subjects, dealt with by specialists drawn in the main from industry, and includes: The Pros and Cons of Systematic Control and Planning in the Engineering Department; The Value of New Materials and Techniques in the Solution of Engineering Problems; Some Current Techniques and Future Trends in the Planning of Plants and their Subsequent Operation; Cost Consciousness and the Engineer; The Impact of Automation on the Plant Engineer; Lubrication; Combustion and Steam Raising; Oil-Firing; Steam Utilisation; Space-Heating; Thermal Insulation of Industrial Buildings; Electrical Systems in Factories; Materials Handling; Properties and Treatment of Metals and Alloys; Developments in Welding Practice; Industrial Accident Prevention; Management in Plant Engineering. Designed to encourage the most effective use of existing knowledge and to promote the application of up-to-date techniques in works engineering practice over a broad field, the purpose of the refresher course is to help works and plant engineers to make the fullest possible contribution to increasing productivity. The fee for the complete course is four guineas, and copies of the syllabus and full particulars may be obtained from the Secretary to the Refresher Course, Department of Engineering, The University, Leeds, 2.

ATMOSPHERIC POLLUTION The amount of attention which is now being directed towards the problem of atmospheric pollution and its prevention in large cities and industrial areas in all parts of the world was shown by the fact that nearly two hundred delegates from twenty-nine countries attended the International Conference on Clean Air, held at Seymour Hall, London, from October 20th to October 23rd. This conference, which was the first international gathering of its kind, was also attended by about a thousand delegates from the United Kingdom. Both the Conference and the Exhibition held in connection with it, were organised by the National Society for Clean Air—which originated in 1899 as the Coal Smoke Abatement Society—to celebrate the Diamond Jubilee of the Society. It is reported that seventy-five written contributions were presented for discussion, and they covered a comprehensive range of subjects. Together with papers on the need for, and promotion of, closer international co-operation, there were discussed national air pollution problems, legislation and administration in this and other countries. The discussions on these subjects, and the sessions dealing with technical problems in preventing pollution, its investigation and measurement, and medical and other research in progress, provided all delegates with useful information, which could possibly lead to new approaches to a subject which is of vital importance to all communities. Attention was also paid to the growing problem of fumes from road vehicles. The value of this conference will undoubtedly be enhanced by its international aspect, as it provided delegates with an excellent opportunity to discuss their individual problems and the progress which has been made in technical methods or by legislation in different parts of the world.

INSTRUMENTS, ELECTRONICS AND AUTOMATION EXHIBITION The International Instruments, Electronics and Automation Exhibition, to be held at Olympia, London, during May, 1960 (under the patronage of H.R.H. the Duke of Edinburgh), will, it is claimed, be double the size of the last exhibition, which was held in 1958. The Grand Hall, the Extension and the National Hall will be occupied by more than 450 firms. More than 100 of these will represent a dozen foreign countries. Net amount of stand space already booked totals 140,000-sq. ft. This makes the I.E.A. the largest specialised instruments and electronics exhibition in the world. There will be more than 150 new exhibitors, 25 of them from overseas. Trade associations promoting the exhibition are:—The British Electrical and Allied Manufacturers' Association; The British Industrial Measuring and Control Apparatus Manufacturers' Association; the British Lampblown Scientific Glassware Manufacturers' Association; the Drawing Office Material Manufacturers' and Dealers' Association; the Electronic Engineering Association; and finally, the Scientific Instrument Manufacturers' Association of Great Britain.

The Effect of Non-Uniform Heat-Distribution on Steam Generation in Tubes

By P. G. MORGAN*

IN the majority of designs of steam-producing equipment it is the usual practice for steam to be generated by the application of heat to a tube system containing water, or a mixture of water and vapour. The general form of generation is by bubbles of vapour emanating from discrete points on the heated surface, but, with higher rates of heat flow through the surface of the tube, a transition occurs to film boiling, in which a thin layer of vapour occupies the space adjacent to the heated surface. This effectively prevents the transfer of heat to the bulk of the fluid with the result that there is a sharp rise in temperature of the heated tube (Fig. 1); if this condition continues over a sufficiently long period failure of the tube occurs. In laboratory investigations, it is generally most convenient to arrange for uniform heating around the perimeter of the tube, e.g., by means of a tubular electric heater, but in most industrial applications this ideal condition does not arise. In water-tube boilers, for example, the heat supply to the water-vapour mixture in a boiler tube is irregularly distributed around the perimeter. Recently reported Russian work(1) has been concerned with the effect of this non-uniform heat distribution on the transition from bubble to film boiling, i.e., the critical heat flux, and a summary of the work is given below.

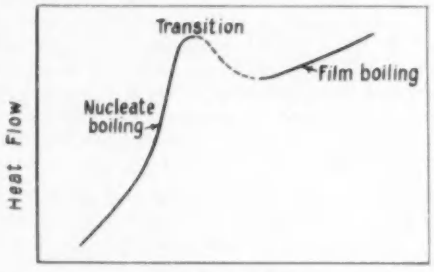
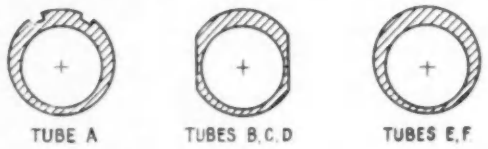


Fig. 1. Curve indicating the sharp rise in temperature of a heated tube.

The tubes used in the investigation were of two groups, the first of internal diameter 5.65 to 6.03 mm. and the second of internal diameter 18.65 mm., with a constant ratio of length to tube diameter for each experiment of 25. The material used in each case was ordinary boiler tube steel. Each tube was specially prepared, and from the details of the sections shown in Fig. 2, it is clear that the inner and outer perimeters are eccentric, giving a variation in the tube wall thickness. The non-uniform heat flow was provided by passing an electric current through the tube itself, and, on the assumption that the current distribution in the section of the tube obeys Ohm's law, the maximum current flows at the point of maximum thickness. The maximum heat flow into the water-vapour mixture is thus associated with the thickest part of the tube wall.

Thermocouples attached to the wall of the tube were used to measure the temperature changes in the tube associated with the different regimes of boiling. For certain conditions, i.e., low pressures and low flow rates,



	Tube						
	A	B	C	D	E	F	Uniform
Int. Dia. (mm.) ...	5.65	13.65	5.65	5.95	5.95	5.95	6.0-18.65
q max / q mean ...	1.80	1.53	1.64	2.08	2.73	2.53	1
q max. / q min. ...	3.9	3.1	3.9	18	13	18	1

Fig. 2. Section through tubes used during investigations.

the transition from bubble to film boiling could be observed visually by the reddening of the outside wall of the tube, but, in general, the thermocouple readings provided the most definite indication of the transition.

In the evaluation of the experimental results, three values of the heat flow were used:—

- q max. the maximum heat flow to the inside of the tube, at the point of maximum thickness.
- q min. the minimum heat flow, at the point of minimum thickness.
- q mean the mean heat flow.

The degree of non-uniformity is measured by the ratios $\frac{q\ max.}{q\ mean}$ and $\frac{q\ max.}{q\ min.}$, determined from the tube geometry, and tabulated in Fig. 2.

Experiments were carried out at pressures of 26, 100 and 180 atmospheres, with flow rates in the range 200 to 2,000 $\frac{kg.}{metre^2\ sec.}$ and steam content x of the flowing mixture from 0 to 100 per cent. For pressures of 26 and 100 atmospheres and flow rates of 200, 400 and 800 $\frac{kg.}{metre^2\ sec.}$ (and also 1,200 $\frac{kg}{metre^2\ sec.}$ for p = 26 atmospheres), the critical heat flow at first increases with increased steam content from its value for x = 0, reaches a maximum at some intermediate value and falls again. For x = 1, q max. critical approaches zero. For p = 100 atmospheres and a flow of

* *Department of Engineering, University of Manchester.*

2,000 $\frac{\text{kg.}}{\text{metre}^2\,\text{sec.}}$ and for all the investigations at p = 180 atmospheres, the curve of q max. critical as a function of the steam content for a constant flow rate takes the form of a continuous downward slope.

Fig. 3 shows the relation between the critical heat flow and the steam content, obtained experimentally for 6 mm. diameter tubes, flow rate 850 $\frac{\text{kg.}}{\text{metre}^2\,\text{sec.}}$ and pressures 100 and 180 atmospheres. It is seen that the non-uniformity of heating has little effect on the character of the curves, and only affects the absolute

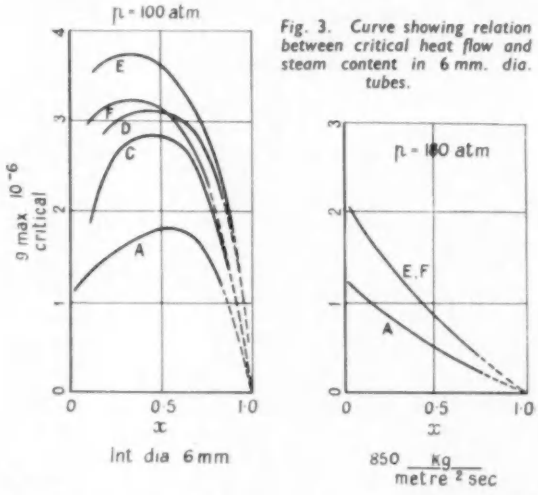


Fig. 3. Curve showing relation between critical heat flow and steam content in 6 mm. dia. tubes.

values of q max. critical, which increase with increased non-uniformity of heating, characterised by the ratio $\frac{q\ \text{max.}}{q\ \text{mean}}$. Fig. 4 gives the experimental results for uniform and non-uniform heating of tubes of internal

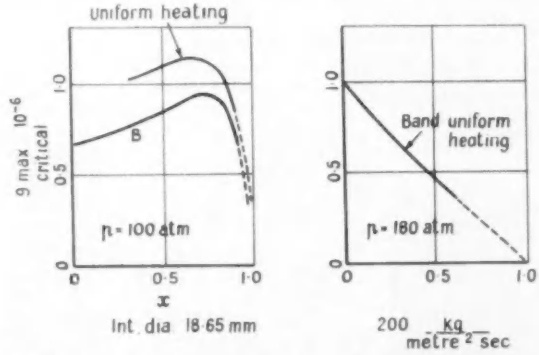


Fig. 4. Curves showing experimental results for uniform and non-uniform heating of 18.65 internal dia. tubes.

diameter 18.65 mm., flow rate 200 $\frac{\text{kg.}}{\text{metre}^2\,\text{sec.}}$ and pressures of 100 and 180 atmospheres. Comparison of Figs. 3 and 4 shows that with increased tube diameter the effect of non-uniformity of heat flow on q max. critical is reduced; for the 18.65 mm. diameter tube, p = 100 atmospheres, the critical heat flow for non-uniform heating exceeds that for uniform heating by about 25 per cent., but for p = 180 atmospheres there is no observable difference.

The influence of the tube size on the non-uniform distribution of heat flow and the critical heat flow may

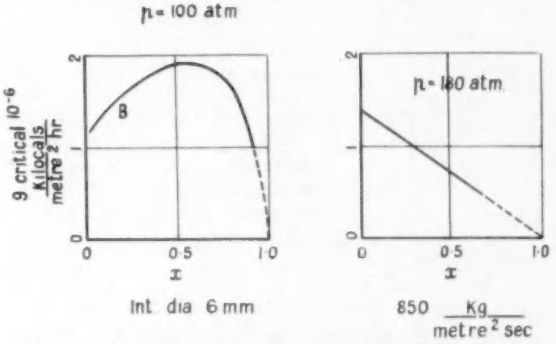


Fig. 5. Curves showing results of experimental work for 6 mm. internal dia. tubes.

be explained as follows. The critical heat flow, i.e., when the transition occurs from bubble to film boiling, occurs initially at some local point, determined by the hydrodynamic conditions within the tube. With non-uniform heating the flow is not symmetric about the axis of the tube, and in general, where the heat flow into the water-vapour mixture is a minimum, the steam content is reduced, i.e., there is a higher water content in the boundary layer. Due to the non-uniformity of the flow, a secondary, transverse circulation is imposed on the axial flow, with a resultant flow from the region of low heat flow, i.e., high water content, to that of high

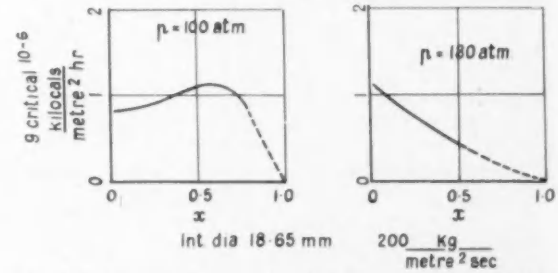


Fig. 6. Curves showing results of experimental work for 18.65 internal dia. tubes.

heat flow; this makes it difficult to form a steady vapour film adjacent to the tube wall and increases the value of q max. critical. For small diameter tubes (6 mm.) the distance between the points of maximum and minimum heat flow is small and the influence of the non-uniformity on the critical heat flow is large. On the other hand, for the larger diameter tubes (18.65 mm.) the gradient of heat flow around the perimeter of the tube, shown by $\frac{q\ \text{max.}}{q\ \text{mean}}$ and $\frac{q\ \text{max.}}{q\ \text{min.}}$, is much less, with a greater distance between the regions of different heating, thus weakening the influence.

From the experimental data, an empirical equation governing the influence of the non-uniformity of heating around the perimeter has been suggested. It is:—

$$\frac{q \text{ max. critical}}{q \text{ uniform critical}} = 1 + \frac{12\,(1 - 0.4x)}{Pe_{\text{uniform}}^{0.25}\, Pr_{\text{uniform}}} \left(\frac{q \text{ max.}}{q \text{ mean}} - 1\right)$$

where

q max. critical = the local value of the heat flow at the position at which the critical heat flow occurs (the thickest part of the perimeter) in. $\frac{\text{kilocals}}{\text{metre}^2\,\text{hr.}}$

q uniform critical = as above, but for uniform heating, in $\frac{\text{kilocals}}{\text{metre}^2\,\text{hr.}}$

x = steam content for the flow at the point at which the transition occurs.

Pe uniform, Pr uniform = the non-dimensional Peclet and Prandtl numbers, based on the flow parameters at saturation temperature.

Figs. 5 and 6 show the results of experimental work, where the ordinate is:—

$$q \text{ critical} = \frac{q \text{ max. critical}}{1 + \frac{12\,(1 - 0.4x)}{Pe_{\text{uniform}}^{0.25}\, Pr_{\text{uniform}}} \left(\frac{q \text{ max.}}{q \text{ mean}} - 1\right)}$$

Fig. 5 is for the 6 mm. diameter tube with a flow rate of 850 $\frac{\text{kg.}}{\text{metre}^2\,\text{sec.}}$, and Fig. 6 for the 18.65 mm. diameter tube with a 200 $\frac{\text{kg.}}{\text{metre}^2\,\text{sec.}}$ flow rate. The values obtained experimentally differ by some 25-30 per cent. from the line corresponding to 9 uniform critical obtained for uniform heating.

Reference

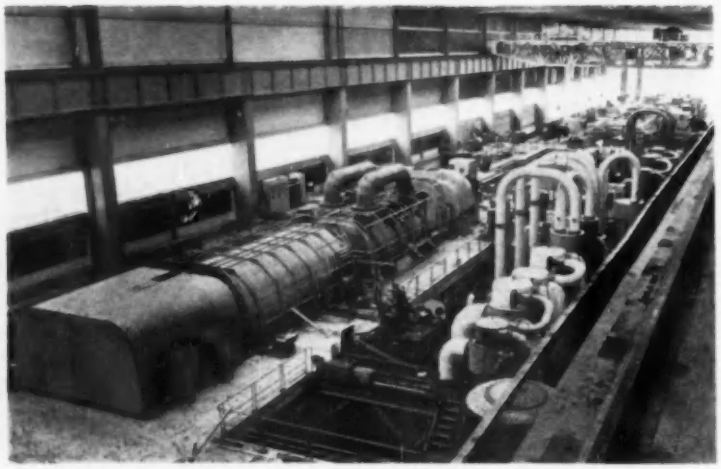
(1) Styirikovich, M. A., Mostinskii, I. L. Doklady Akad. Nauk. S.S.S.R. 127, 2, p. 316. (1959).

Britain's Most Powerful Turbo-Generator on Load

LATE on Thursday, October 15th, the most powerful turbo-generator in Britain, or even in Europe, was put into service at the Central Electricity Generating Board's High Marnham power station, near Retford, Notts. The development of more powerful generating sets is resulting in considerable economies; the overall dimensions of these large sets have not increased proportionately with output, which means that power station buildings accommodate more plant capacity per unit volume compared with those built 10 years ago. The older stations averaged 50 cu. ft. per kW installed, compared with new stations with as low as 28 cu. ft. per kW installed. Very considerable economies are therefore possible in the design and construction of power stations housing these more powerful sets with their associated unit boilers. Power stations today are being constructed at approximately the same cost (£50 per kW installed), as in 1948, despite a 70 per cent. increase in the costs of materials and labour.

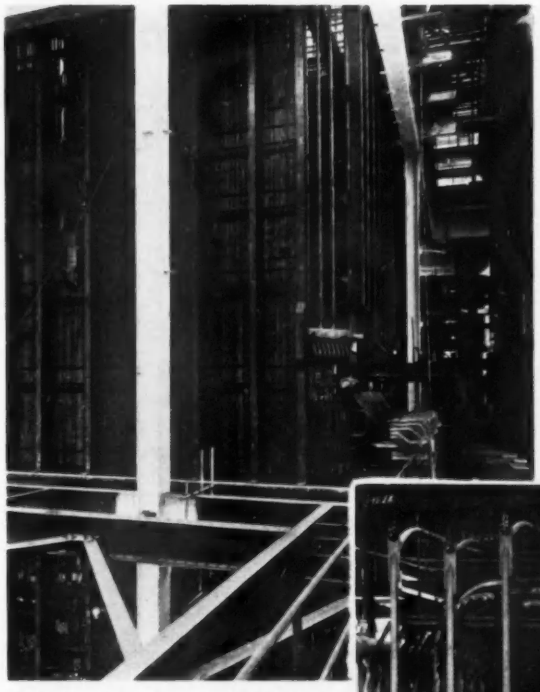
The machine at High Marnham is the first of five similar units which will be installed in the station, and when all are in commission the station will thus have an installed capacity of 1,000-MW, twice the installed capacity of Battersea power station. When in full operation the boilers at High Marnham will consume more than 9,000-tons/day of coal. The main civil engineering works at the station site were started in 1956, and construction of the generating plant began a year later. A total labour force of up to 1,800 men has been engaged. The new turbine and alternator which were constructed by The English Electric Co. Ltd., are the largest ever to leave the Rugby and Stafford works of the company. The turbo-alternator was also the first tandem 200-MW unit to be manufactured in Britain, and is typical of the most advanced designs now in course of manufacture in the English Electric works where, incidentally, the largest turbo-alternators now on order are the 275-MW reheat sets for the Blyth "B" power station in the North Eastern Division of the C.E.G.B.

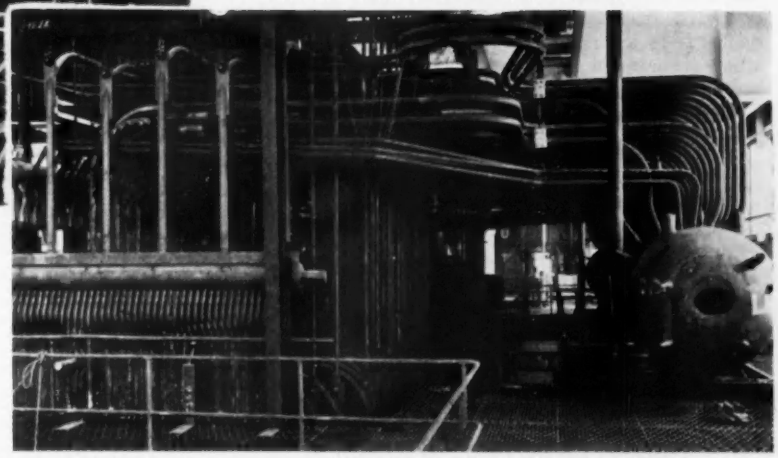
At High Marnham, the five units are being arranged in line along the turbine hall at 120-ft. centres. The total weight of one turbo-alternator is 1,450 tons, the heaviest component being the alternator stator at 168 tons. With an operating speed of 3,000 r.p.m., the turbine is of the horizontal three-cylinder design having a double-casing impulse-type high-pressure cylinder. Steam enters the turbine stop-valve at 2,350-lb./sq. in. and 1,050 deg. F.—the highest steam conditions so far attained in any British power station. The steam from the high-pressure turbine exhaust is taken to the reheater and then returned to the



The first of the five tandem 200-MW turbo-generators which are being constructed for High Marnham by The English Electric Co. Ltd., shown installed in the station.

intermediate-pressure cylinder at 475-lb./sq. in. and 1,000 deg. F. The intermediate-pressure cylinder is combined with one section of the three-flow low-pressure cylinder and has impulse stages up to the point of exhaust to the low-pressure stages.





(Above). Side view, and (right) view at drum-level, during final stages of erection, of the first of the five 1,400,000 lb./hr. boiler units being supplied by International Combustion Limited, for steaming the 200-MW sets.

Approximately one-third of the steam remaining after bleeding passes through the combined low-pressure portion, and the remaining two-thirds is led through two overhead interconnecting pipes to the double-flow, low-pressure cylinder. The three-flow low-pressure cylinder exhausts to a single-shell condenser, the vacuum at the most economical and continuous maximum rating being 28.7 in. Hg. (Bar. 30-in.) when using cooling water at 60-deg. F. The condensing plant, the largest yet to be built in Britain, includes a 115,000 sq. ft. single-shell condenser, two full-duty extraction pumps, three 50 per cent. duty rotary " Leblanc " type main air pumps and two quick-starting exhausters. There is a six-stage feed-water system providing a maximum temperature of 460 deg. F. at continuous maximum rating. The alternator associated with this turbine is of the latest hydrogen-cooled design, employing direct-cooling of the stator and rotor conductors at a rated gas pressure of 30 lb./sq. in. Generation is at 16,500-V, the design power factor, short circuit ratio, and rated phase current being 0.9, 0.75, and 7,780-amp respectively.

The boiler unit serving the set was designed and constructed by International Combustion Limited, and is the first 200-MW re-heat steam generator to be commissioned, and the first boiler unit to embody the principles of " controlled and assisted circulation " in Great Britain. The operating conditions of the boiler are:—

Steam pressure	2,450 lb./sq. in.
„ temperature	1,060 deg. F.
Re-heat temperature	1,005 deg. F.

Evaporative capacity at continuous maximum rating is 1,400,000 lb./hr. Steam is returned from the turbine to the reheater at a pressure of 476 lb./sq. in., and at a temperature of 667 deg. F. The boiler has separate superheat and reheat furnaces, with all pressure parts slung from the main boiler house overhead steelwork. Each furnace is provided with 16 pulverised-fuel burners, four at each corner arranged for tangential firing. The burners are of the tilting type to provide control of the temperature of the steam leaving the superheater and reheater. Spray desuperheaters are incorporated as an emergency control to maintain the steam temperature at a safe level during abnormal operating periods. Six p.f. mills are provided for the boiler, their individual capacities (28.4 tons) being such that with normal fuel and operating conditions, four mills will be sufficient to meet full load on the boiler.

MOULDED CASE CIRCUIT-BREAKERS

At an exhibition in London on October 6th and 7th a range of moulded case circuit-breakers was introduced by **E.C.C. Moulded Breakers Ltd.,** Wolverhampton. The range comprises the NEF and NI type breakers and the " Stab-lok " series of distribution boards in which circuit-breaker units are pressed into place in flush or surface mounting boards. These are made with from 4 to 36 ways with s.p. and n. units rated at 5 to 60-A, and from 4 to 12 ways with 5 to 60-A t.p. and n. units. The breakers have silver tungsten contacts and spring accelerated quick-make and quick-break action. The NEF range of circuit-breakers is available in single, double or triple pole versions and covers the range of 15 to 100-A at 440-V a.c. or 250-V d.c. The contacts are of silver alloy and a thermal magnetic tripping unit is incorporated. Breakers in the NJ range are of the triple-pole type and are available rated at from 70 to 400-A at 600-V a.c. These units have been tested at 10,000-A, 600-V a.c. A number of " Stab-lok " distribution boards were displayed, with examples of moulded case breakers incorporated in control switchgear, including a contactor type starter having a circuit-breaker unit as an interlocked isolating switch, a control panel for an 80-kW alternator incorporating a main circuit-breaker unit.

Development of Boiler Design by Sulzer Brothers Limited

This year Sulzer Brothers Limited, Winterthur, celebrate the 125th Anniversary of their foundation, and in the August, 1959 issue of "Engineering and Boiler House Review" was included an article dealing with the history of the Company. A reference was made in these notes to Sulzer steam boilers. This was, however, necessarily brief, and we now publish a more comprehensive article dealing with this important aspect of the Sulzer organisation

THE first boiler known to have been constructed by Sulzer Brothers Limited dates from 1841, and until about the end of the century, all units manufactured were of the type with a large water-space, among them being multitubular boilers. Early in the twentieth century the construction of water-tube boilers was undertaken with a view to attaining higher ratings and pressures. These were of the straight-tube designs, but the trend towards higher pressures and temperatures called for a transition to more flexible designs with bent-tubes, as embodied in the two-drum double-bank boiler, and later in the radiant-type boiler with a single-drum which is now built in a number of forms. Towards the end of the First World War the shortage of coal in Switzerland led to the construction of the first electrode boilers. Later electrode boilers and accumulators were combined in one unit, as were also electrode and coal-fired boilers. A new departure came in the early 'thirties with the introduction of the forced-circulation principle (La Mont boiler), which was adopted for a time in special cases for boilers of low and medium rating, operating at medium pressures. Sulzer Brothers were among the first manufacturers of forced-circulation boilers in Europe. Of even greater importance, however, was the development, a few years earlier, of the first Monotube steam generator. This design was to become, in the ensuing years, characteristic of the Sulzer range of high-pressure boilers, and is today manufactured outside Switzerland also by a number of licensees. The introduction of pulverised-coal firing was another important step in the evolution of modern high-capacity boilers, but since pulverised-coal firing systems are not often required for boilers installed in Switzerland, and economic considerations stand in the way of the export of such systems, it was decided not to develop and manufacture a Sulzer design. The same applies to medium and large grate-type stokers. For small boilers, however, Sulzer underfeed stokers are supplied, as are also oil-burners for fairly high unit ratings.

Sulzer Brothers today construct boiler plants for most practical requirements, ranging from 1,000 to 2,000,000 lb./hr. for the very largest units; from steam pressures of a few atmospheres up to super-critical pressures of around 5,000 lb./sq. in.; and from steam temperatures not far above 212 deg. F. up to as much as 1,200 deg. F. In the following paragraphs a brief survey is given of the principal boiler types manufactured by the company.

Boilers for heating systems

Boilers for heating duties only include the traditional fire-tube unit—still occasionally used today—and combined fire-tube and multitubular units built in the form of Economic or three-pass boilers. Large heating systems often employ high-temperature water. Such systems usually operate at a constant-flow temperature and consequently require the maintenance of constant-pressure in the boiler. The only method of storage is then the provision of a reserve of high-temperature water, and vertical constant-pressure accumulators operating on the displacement principle—a speciality of Sulzer Brothers—are adopted for this purpose. Boilers of low storage capacity can be used in this connection, and during the past 10 years the company have developed a small-capacity radiant-type unit. Boilers of this design usually operate at pressures up to 350 lb./sq. in., and are rated at up to 22,000 lb./hr. or 24-million B.Th.U./hr.

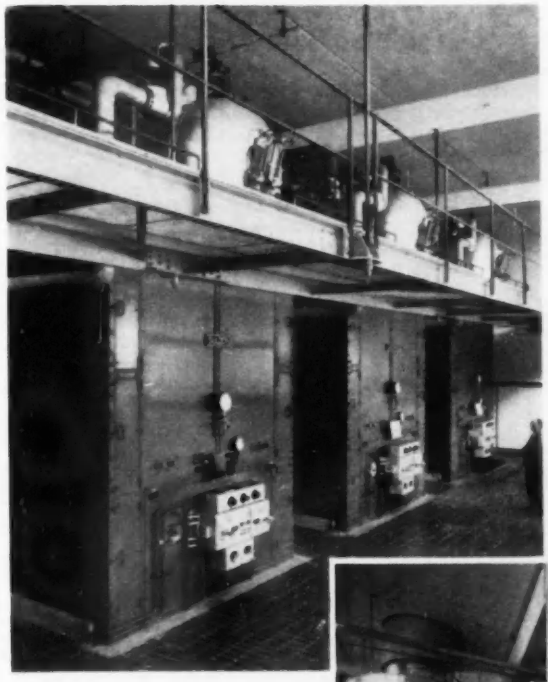
A special type of boiler for heating purposes is the electrode boiler. Three different designs of such unit are manufactured by the company today:—those employing resistance heating for low ratings and voltages up to 500; boilers with immersed electrodes for voltages up to approximately 6,000; and jet-type electrode boilers for high-voltages up to 3,000. Where resistance heating is used, the feedwater does not have to fulfil any particular requirements in the way of electrical conductivity, but in the two remaining types, certain limits have to be observed in this respect. Small-capacity electrode boilers are often combined with accumulators which are charged during the night and discharged in the daytime.

Boilers for power stations and back-pressure plants

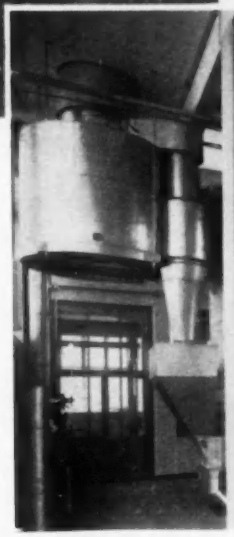
The boilers used for power generation are, of course, characterised by higher operating pressures, superheating of the steam (with reheat in large condensing plants) and higher feed-water temperatures. The ratings of industrial back-pressure plants range from about 10,000 to 500,000 lb./hr., and considerably larger units are installed outside Switzerland. Public utility power stations, in the larger industrial countries, today employ boilers generating from about 500,000 lb./hr. upwards, and steaming turbines of 50 to 250-MW. A few plants of still higher capacity are now under construction, and there is a definite trend towards these high unit ratings.

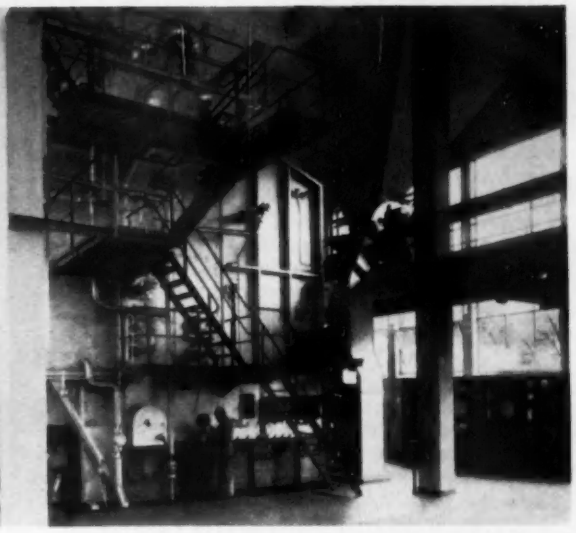
The once-popular sectional boiler is still occasionally installed today, but the sectional tube bank is not very flexible, and for this reason Sulzer Brothers manufacture

this type only for comparatively low ratings up to 50,000 lb./hr., for pressures up to 450 lb./sq. in., and for moderate steam temperatures. A more flexible tube system is found in the two-drum double-bank boiler. With this type somewhat higher superheat temperatures up to the region of 850 deg. F. can be attained. Like the sectional boiler, it is provided with a brick setting. Where brickwork is cheap, this simply constructed boiler can be used to advantage for plants operating at medium pressures up to about 700 lb./sq. in. and raising from about 25,000 to 175,000 lb./hr. As with the sectional boiler, all the customary designs of mechanical stokers can be adopted, as well as oil and gas-firing systems.



(Above). An installation of three Model C radiant-type boilers, each designed for an m.c.r. of 11,000 lb./hr. at 185 lb./sq. in. All three boilers are oil-fired, but the unit on the right is also fitted with an extension grate to burn waste materials (note trapdoor in floor).





(Right). Side view of radiant-type boiler fitted with travelling-grate stoker, and rated at 22,000 lb./hr. at 580 lb./sq. in. and 800 deg. F. In the top left corner can be seen a Sulzer-van Tongeren dust-separator; on the right, the control panel; and on the platform, top right, the F.D. fan.

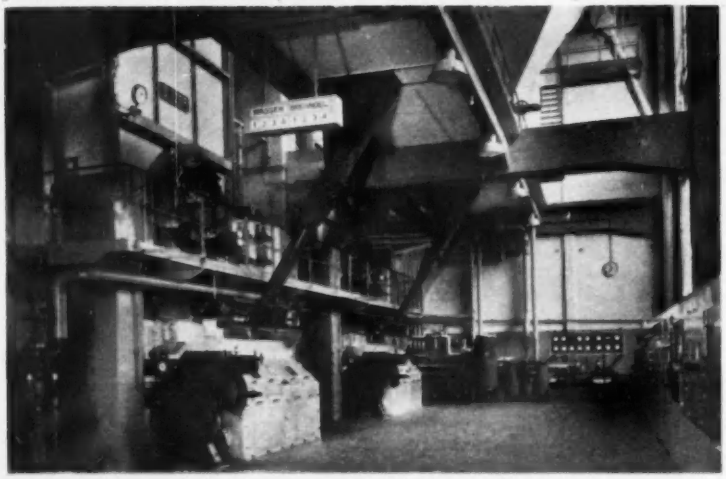
A new type of boiler for low ratings up to 55,000 lb./hr., but otherwise for roughly the same range of steam pressures and temperatures as the two-drum, double-bank boiler, is the Model N radiant-type boiler. This design satisfies the modern wish for less brickwork, and reduced space requirements for a given rating. Mechanical stokers, or firing systems for oil or gas can again be used. Unlike the other boilers for industrial power generation or back-pressure applications so far mentioned, this design has a furnace which is extensively lined with cooling tubes. The close pitch of these tubes enables the brickwork to be partly replaced by insulating material; the boiler being enclosed in a sheet-metal casing. As the heat absorbed in the furnace is usually insufficient to evaporate the water, an additional evaporator bank is provided after the superheater. The downcomers are unheated with the exception of those for the convection bank just mentioned, which are only slightly heated. The downcomers for the furnace lining are located in the side walls inside the insulating layer. They conduct the boiler water from the drum to the bottom headers of the furnace lining system.

The Model H radiant-type boiler is today the customary form of Sulzer natural-circulation boiler for medium and high ratings from about 50,000 to 500,000 lb./hr. and pressures from 500 to 1,750 lb./sq. in. This boiler has an amply-dimensioned drum which is rigidly supported on the boiler structure. The fittings inside the drum are arranged to allow plenty of room for purposes of internal inspection. There is also sufficient space for the complete separation of steam and water. The tubes lining the furnace are free to expand downwards, the bottom headers being flexibly supported. The combustion chamber is generously dimensioned, and can be constructed for burning either solid fuels, gas, oil or pulverised coal, alone or in combination. The furnace walls are lined with fairly closely-spaced risers, the refractories behind these separating the combustion chamber from the mineral wool insulation, which is followed on the outside by a sheet-metal casing enclosing the whole boiler unit. Here again the water is supplied to the bottom headers through unheated downcomer tubes positioned within side wall insulation. A suitable number of risers is allocated to each of these downcomers. The superheater generally consists of two parts, one of

them a convection tube-bank normally placed at the top of the downward flue and the other a comparatively small tube-bank of predominantly radiant character, situated further upstream in the gas-path. When condensate is used as boiler feed, water is injected between these two superheater sections for the purpose of regulating the final temperature. Where the feedwater is chemically treated (with the exception of total demineralisation), part of the steam coming from the primary superheater is cooled in a desuperheater located within the boiler drum, and is subsequently mixed with the rest of the steam, a three-way valve being employed for distribution purposes. These boilers may be fitted with automatic combustion control, but in any case the feedwater flow is regulated in accordance with the water-level in the boiler drum, while the steam temperature is controlled at the superheater outlet, the draught in the furnace being also controlled. Normal ancillary equipment includes economisers and air-heaters, the latter being mostly of steel tubular design. Boilers fitted with chain-grate stokers also have mechanical dust-separators of the Sulzer-van Tongeren type.

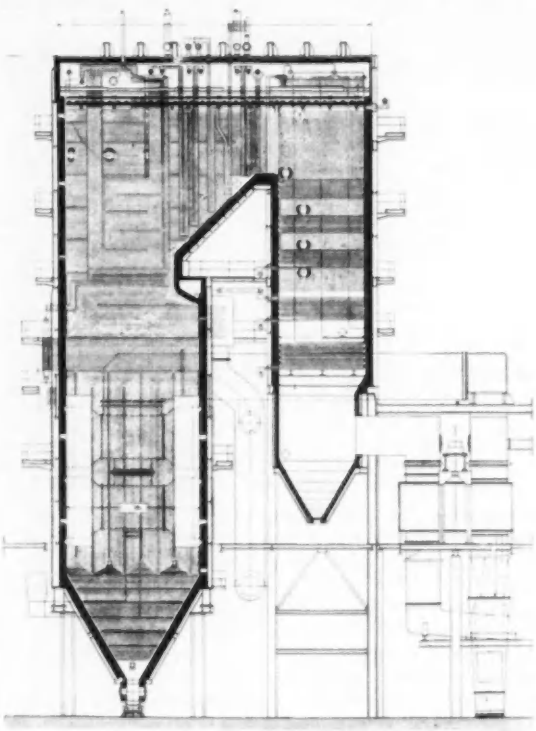
The Monotube steam generator is the design generally employed by Sulzer Brothers for pressures above about 1,100 lb./sq. in., and for high steam ratings, and although this particular type of boiler has undergone many design changes and improvements in the 30 years which have passed since the first experimental unit was constructed, its basic features have remained the same. The water separator, which was installed in the first industrial plant after a short period of service, has been retained in all boilers operating at sub-critical pressures. Its use permits an improvement of the feed-water conditions and also assists in boiler control, since it protects the superheater from flooding. The arrangement of the evaporator section, and the last part of the economiser heating-surface in the furnace in the form of coils of parallel tubes without any intermediate headers, has also remained unchanged. In boilers with mechanical stokers, the tubes in the combustion chamber run horizontally, while in boilers burning pulverised-coal the evaporator tubes are vertical. There has likewise been no change in the basic principle according to which the firing rate is set either manually or automatically, and the feed-water flow and injection rate then automatically adjusted to suit by the control system.

When the boiler is started up from cold, the superheater is cooled by the water which first circulates through the whole tube system, the by-pass pipe and the feed-water tank. This protects the superheater against excessive temperatures, and superheater damage has, in consequence, been a rare occurrence. The system of cooling during the starting phase has also been applied in a somewhat different form to the reheater. While in recent designs there is no initial flow of water through this element, it is cooled by steam from the by-pass pipe as soon as steam generation commences in the high-pressure section of the



(Left). Firing-floor of an installation comprising two Model H radiant-type boilers, equipped with travelling-grates and oil-firing systems, and each rated at 55,000 lb./hr. at 450 lb./sq. in. and 710 deg. F. Above the stokers can be seen the platform giving access to the three oil burners of each unit. In the background are the pumps, filters and preheaters for the fuel oil, and on the right, control panels, switchgear and some of the control equipment.

(Below). Cross-sectional arrangement of a Monotube boiler with tangential burners for p.f.-firing. This unit has a capacity of 405,000 lb./hr., at 2,000 lb./sq. in., with superheat and reheat to 1,015 deg. F.

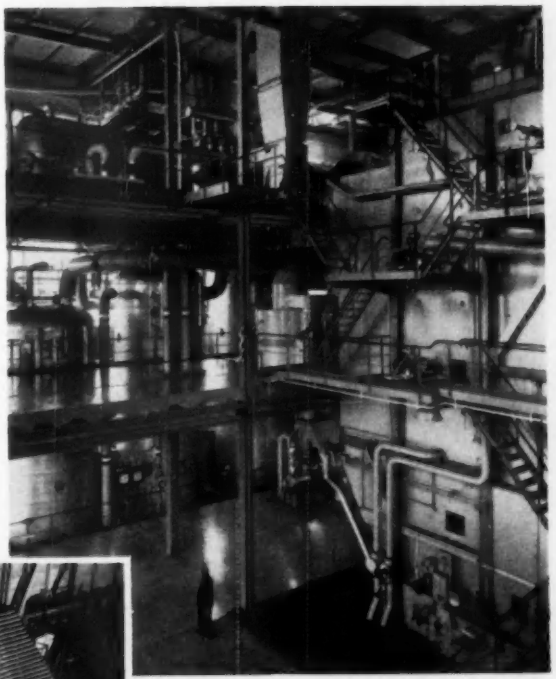


boiler. This steam cooling method has also proved to be very satisfactory, and protects the reheater, for instance, in the event of a turbine failure.

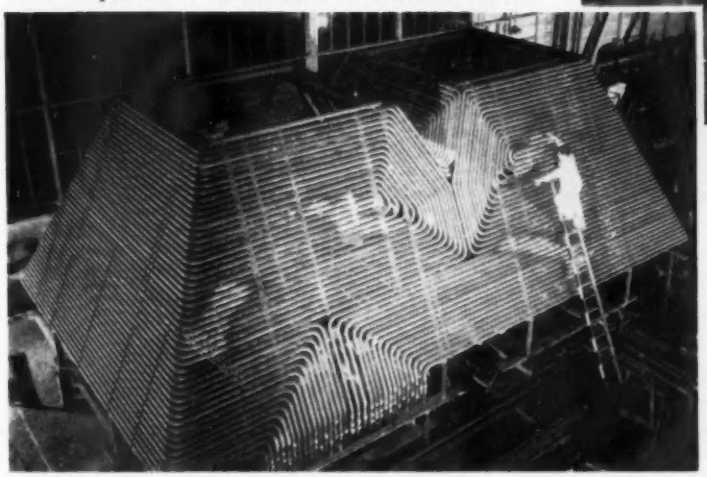
A fairly recent introduction is the "Triflux" heat-exchanger whose heating surface consists of coils of double tubes. The reheater steam flows through the large outer tube and receives heat from high-pressure steam flowing through the smaller inner tube. At the same time the flue gases flow over the outer surfaces of the reheater tubes. This design enables the outlet temperature from the reheater to be kept constant over a wide range of loads by adjusting the amount of heat given up by the high-pressure to the reheater steam. The principle of heat transmission from high-pressure steam to steam at lower pressure was previously adopted in a number of industrial Monotube steam generator plants for the superheating of steam from heat-exchangers.

For many years the regulating valves and control units of Monotube steam generators were manufactured exclusively by Sulzer Brothers Limited. The oil-operated design which they employ has proved to be extremely reliable in service. In the course of time, however, licences for the manufacture of Monotube steam generators have been granted to companies in various countries, and in view of the advances made in recent years in control systems, and in view of the large distances over which signals sometimes have to be transmitted in modern power stations, Sulzer Brothers now also make use of electric controllers. Today, Monotube steam generators can consequently be equipped either with oil-operated or electric or even combined control systems, according to local conditions and the preferences of the operator of the plant concerned. This applies more particularly to the internal control of the boiler. For combustion control other types of controllers have been in use for many years alongside Sulzer designs.

It should be mentioned in connection with the design of the furnace walls that in the boilers built by Sulzer Brothers themselves, the cooling tubes are arranged at a certain pitch, while behind them there is a layer of refractories held in place by special supporting tubes. These refractories are followed by the insulation, which is encased in the external sheet-metal jacket. Some of the boilers built by licensees differ from this design; those constructed in the U.S.A. in particular having combustion chambers lined throughout with tubes which are so close as to be almost in contact. Behind these tubes is an airtight sheet-metal skin, followed by the insulation and the external metal casing. The whole boiler is suspended, as is customary in American designs, the insulation being carried by the tubes.



(Above). Rear view at firing floor level of a Sulzer radiant-type boiler, with service platform for two high-temperature water and one hot-water accumulator. The feedwater tank is accessible from the top platform.

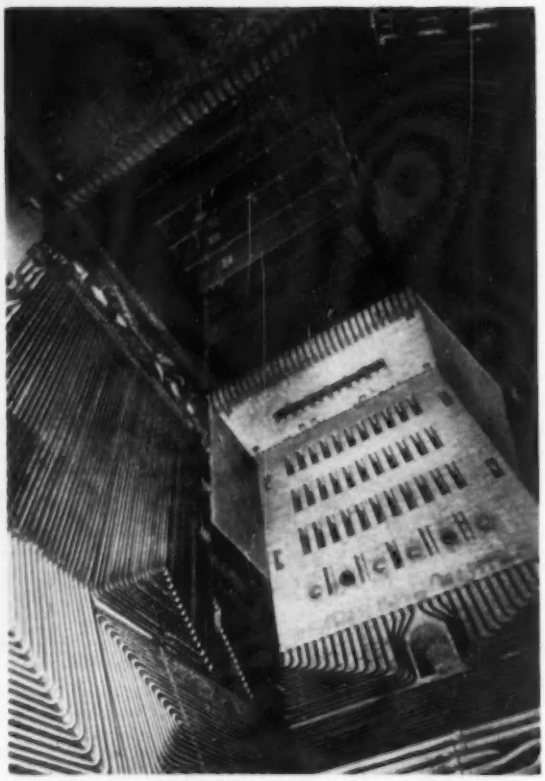


(Left). Tubular lining of the combustion-chamber hopper of a Monotube boiler during assembly at the Sulzer works. The hopper will, of course, be inverted for installation.

The Monotube steam generator is essentially a high-pressure unit and is therefore intended for high ratings. Most of these boilers are equipped with pulverised-coal firing systems and are used either in large central power stations or in large industrial plants. In the latter, the high steam pressure, combined with the given process-steam pressure and demand, usually results in a high power yield. The boilers may be used either with back-pressure, extraction back-pressure or extraction/condensing turbines.

It has already been mentioned that once-through boilers are the only type suitable for super-critical pressures. In condensing power stations, with outputs

of at least 250-MW per unit, overall thermal efficiencies of approximately 40 per cent. are obtained at initial steam and re-heater temperatures of 1,050 deg. F. at the turbine inlet. At the present time three Monotube steam generators for super-critical pressures are being constructed by the Sulzer licensees in the U.S.A., and the first of them is scheduled to commence operation this year. Two of the boilers are designed for turbine ratings of 358-MW and one for 250-MW. The maximum continuous ratings are 2,000,000 and 2,180,000 lb./hr. for the 358-MW sets and 1,710,000 lb./hr. for the 250-MW set.



Combustion chamber of a Monotube boiler, with double-U pulverised-coal firing, rated at 405,000 lb./hr. at 2,000 lb./sq. in., with superheat and reheat temperatures of 1,015 deg. F. In the roof, top left and centre, are the openings for the p.f. burners; and to the right below them, in the vertical wall, the secondary-air openings.

The many auxiliaries associated with modern steam plants include pressure vessels and heat-exchangers for various purposes, pipes, controllers and fittings, in addition to the boilers themselves. These components are also manufactured by Sulzer Brothers, who have made a special study of the requirements of industrial plants, where the widest variety is encountered both in equipment and design and in layout.

Future prospects

Industrial heat and power requirements are constantly increasing, and only a small part of the demand can be met from hydro-electric sources. Nuclear power applications, although possibly of the greatest long-term importance for the future, will only gradually replace the major conventional power generating system in use today, viz., the coal-fired steam-raising plant. As the ratings of gas turbines are also limited by comparison with steam turbines, there can be no doubt that the steam boiler and turbine will hold their leading position in the power generating field for many years to come.

For central power stations, unit ratings from one hundred to several hundred MW, corresponding to steam outputs from perhaps half a million to three or four million lb./hr., will be increasingly used, in many cases in conjunction with super-critical steam pressures. It is uncertain at present how far it will be possible to raise temperatures. At the moment, no further increase in the maximum steam temperature used so far, viz., 1,200 deg. F., seems likely, at least not on any large scale. Most of the large plants erected during the next few years will probably operate at final steam temperatures not in excess of 1,050 deg. F. In the same way, the conventional fuel-fired boiler will probably continue to hold its place in the industrial field, whether it is used solely for generating steam for process purposes, or in back-pressure or extraction condensing service. Nuclear power, even when it becomes a more economical proposition, will initially be reserved for very large installations.

In the long run, however, the generation of power from nuclear sources will become more widespread, and for this reason Sulzer Brothers have now been concentrating for some years on the problems of the peaceful uses of nuclear energy, and are already in a position to submit proposals for nuclear power stations.

In conclusion, we should like to record our indebtedness to Sulzer Brothers Limited for supplying much of the technical information and for the illustrations included in this article.

The tenth annual report of **The Gas Council,** issued on October 13th, 1959, showed, for the first time since nationalisation, a deficit for the year. This amounted to £1,466,882. Last year, there was a surplus of £2,820,610. Some points arising from the report were:—*Import of liquefied natural gas*—Trial voyages have been successfully completed, and the aim is now to build one 20,000-ton or two 10,000-ton ships to carry the equivalent of 2-million tons of coal in 13 or 14 normally scheduled trips a year. *High-pressure processes*—Site preparation work is well advanced for the plant to hydrogenate oil or coal at high-pressure which is to be installed at the Partington Works of the North Western Gas Board as part of the Gas Council's research programme. *Complete gasification*—The construction of the Lurgi high-pressure complete gasification plant for the Scottish Gas Board at Westfield, Fife, has begun, and the West Midlands Board have received planning permission for a similar unit to be installed at Coleshill, near Birmingham. Ministerial approval for this project has been received in principle. *Efficiency*—The overall thermal efficiency of gas production increased during the year from 77.4 to 77.7 per cent., and the average yield of gas per ton of coal carbonised from 75.8 to 76.7 therms.

* * *

The **General Electric Co. Ltd.** has received an order for the two 200-MW turbo-alternators for the Kincardine generating station of the South of Scotland Electricity Board. The sets are the largest so far ordered for a Scottish power station, and the order includes the condensing and feed heating plant. The turbines will be designed for steam conditions of 2,350 lb./sq. in., 1,050 deg. F. with reheat to 1,000 deg. F., and a final feedwater temperature of 460 deg. F. The alternators will embody hydrogen-cooled rotors and water-cooled stators.

Large Oil Refinery in Eire

A PROJECT, long conceived, to set up an oil refinery in Ireland has been successfully completed with the construction of a refinery at Whitegate, some 23 miles from Cork, and its official opening by Mr. Sean F. Lemass, the Prime Minister of the Republic of Eire, on Tuesday, September 22nd. The plant, which has a designed capacity of 2,000,000 tons per annum, is operated by the Irish Refining Co. Ltd., which was established as a consortium of the California Texas Oil Corporation, the Esso Petroleum Co. Ltd., and Shell-Mex and B.P. Limited.

The processing plant in this £12 million project comprises a crude oil distribution unit, a copper sweetening plant, a gas hydrofiner and a catalytic reformer. Construction commenced during the autumn of 1957 and the plant has the distinction of being the first entirely air-cooled refinery in Europe. Of the 1,350 acres of land purchased by the company, no more than 120 acres have been developed to contain the whole of the refining plant, the administrative buildings and a 5,000 sq. yd. stores, where spares for all parts of the processing plant will be stocked.

When in full production with an operating staff of approximately 300, Whitegate refinery will supply almost all of Eire's refined oil requirements; these include motor spirit, aviation jet fuel, vaporising oil, diesel and industrial fuels and liquid petroleum gases.

General view of the Whitegate oil refinery of the Irish Refining Co. Ltd.

Transported from the Middle East in tankers berthing at the refinery's marine terminal, the crude oil is pumped by ships' pumps into five storage tanks situated on Corkbeg Island, which is linked by a causeway to the refinery. Each of the storage tanks, holding 6,280,000 gal. of oil, is fitted with a floating roof in order to reduce evaporation to a minimum. With diameter and height respectively 156 ft. and 56 ft., each unit is among the largest storage tanks in Europe. On the mainland are additional storage tanks and for their manufacture approximately 10,000 tons of steel were used—the tanks being weathered for six months to rid them of mill scale. Another unique feature at Whitegate is the type of flare stack used for the disposal of waste gases. Having a diameter of 18 ft., and standing 34 ft. high, it is of the multi-jet type and requires neither steam nor water to render it completely smokeless. In addition, the stack is noiseless when operating, and no flame is visible. An adequate shield against light penetration at the bottom of the stack, where burning of the surplus refinery gases takes place, is the special louvred windbreaker. Flame failure within the stack is signalled by automatic alarms, following which the gases are electrically re-ignited by the operating personnel. Combustion is at the middle of the stack, thereby eliminating flame glare.

Boiler plant

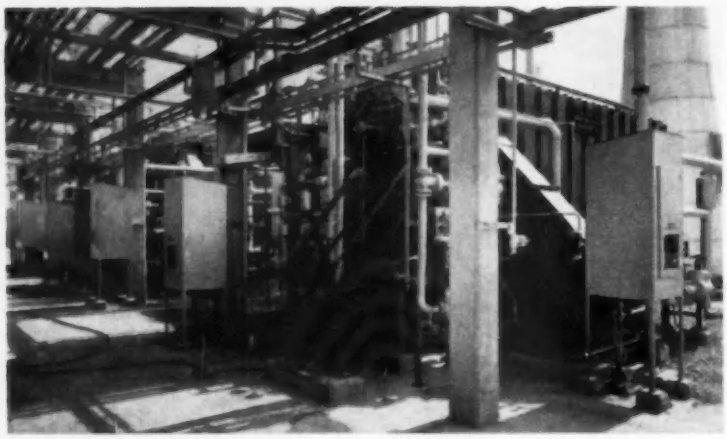
To provide steam for process work, for steam tracing the oil pipelines, and for domestic heating, John Thompson Water Tube Boilers Limited, Wolverhampton, supplied three Type 65.S water-tube package boilers, designed for outdoor installation. These, the first water-tube package boilers to be used in Eire, were completely built at Wolverhampton, so that after transportation by road and sea to Whitegate, little more than connecting-up to power and water supplies remained to be done before the boilers were ready for commissioning. One of the boilers, indeed, provided steam and hot water during the concluding stages of constructing the refinery.

The first boiler arrived on site ready for steam-raising in September of last year; six weeks later the second unit was delivered and, in January, 1959, the last boiler was delivered. Steam is now being supplied to the whole refinery. Each boiler at Whitegate has an evaporative capacity of 32,000 lb./hr., and is fitted with an economiser and superheater, the steam temperature at the outlet of the latter being 450 deg. F. Working at a pressure of 150 lb./sq. in., and with a feedwater temperature of 250 deg. F., the boiler is designed for either oil or gas-firing, and is capable of a 4-hr. peak load at 34,500 lb./hr. Of two-drum design, the boiler incorporates a water-walled combustion chamber, and a single-pass of boiler convection heating surface. Circulation is maintained by a heat-screened downcomer section, and both boiler insulation and casing are designed for pressurisation. The steam drum is 2 ft. 6 in. dia. and the dia. of the mud drum 2 ft. 3 in. Heating surface before the superheater is 260 sq. ft. and after it, 2,150 sq. ft. One John Thompson horizontal-type uncontrolled drainable superheater, with a single-pass on the steam and gas sides, and giving a final temperature of 450 deg. F.

(± 10 deg. F.) is provided with each boiler. The effective heating surface of the superheater is 140 sq. ft.

The John Thompson mild-steel bare-tube economiser with which each boiler is equipped has a total heating surface of 800 sq. ft. The economiser pressurised casing, fully insulated, is made from $\frac{3}{16}$-in. thick steel, and embodies doors and troughs to facilitate water washing.

For the main bank of boiler tubes, a Hopkinsons'



(Left). The three Packaged (Type 655) boilers which each have an m.c.r. of 34,500 lb./hr., were supplied by John Thompson Water-Tube Boilers Limited.

(Below). The water-treatment plant of 12,000 gal./hr. capacity, was supplied by John Thompson-Kennicott Limited.

2-in. hand-operated, multi-nozzle, rotary-type sootblower, capable of withstanding gas temperatures up to 1,650 deg. F., is installed. Similarly, a sootblower of the same type is provided for the superheater ; but in this instance, it is designed to withstand gas temperatures of up to 2,000 deg. F. To avoid wasting the continuous blow-down steam, it is utilised as water for feeding the de-aerator, the steam afterwards passing to drain. Recirculating pumps—one per economiser—were supplied by Rhodes, Brydon and Youatt Limited, Stockport. Each pump, which is driven by a 1.0 b.h.p. squirrel-cage motor, is capable of delivering 10,800 lb./hr. of water at a temperature of 366 deg. F., against a differential pressure of 15 lb./sq. in. when running at a nominal speed of 1,450 r.p.m. and when using 0.68 b.h.p.

The boiler plant is entirely self-contained so far as the provision of power is concerned. In this connection, all pumps are steam-driven, although electrical pumps are provided as stand-by units. Both steam and electrical pumps were made and supplied by Hayward Tyler & Co. Ltd., Luton, the steam operated units being driven by 35 b.h.p. turbines, and the electrical units by 40 b.h.p. Metropolitan-Vickers motors. At present, the boilers are oil-fired, but when the refinery is in full production it will supply much of its own gas, some of which will be utilised for boiler firing. In order to provide for these changes, each boiler is fitted with two Hamworthy type 16.F steam-atomising and natural gas burners suitable for operating with forced-draught.

The refinery plant also supplies the fuel oil, which is heavy residue from the pipe still and which approximates to 3,000 secs. Redwood. Viscosity is, however, somewhat variable. Oil fuel, kept at a temperature of 270 deg. F. in a steam-heated storage tank, is pumped to the Hamworthy burners through a 4-in. dia. steam-traced ring-main. A feature of the fuel-oil circulating arrangement is that, if the electrical units should fail, provision is made for the steam-driven pumps to come automatically into action.

Variable speed controlled, forced-draught fans, supplied by James Howden & Co. Ltd., are provided. There is one such fan for each boiler, its volume being 10,200 cu. ft./min. at 60 deg. F., and its speed 2,200 r.p.m. The fan-driving gear comprises a 25 b.h.p. Hayward Tyler steam turbine exhausting to a back-pressure of

15 lb./sq. in. and is coupled to a 4-in. centre double-helical reduction gear unit supplied by Crofts (Engineers) Limited, Bradford. Operating pressure of the turbine is 150 lb./sq. in. at 450 deg. F. Boiler outlet gases are conveyed to two, John Thompson self-supporting mild-steel chimneys, each 100 ft. high, and with a top dia. of 5 ft. opening out, at base, to 9 ft. 6 in.

By means of a Fisher control valve, rated to operate at 300 lb./sq. in., and 800 deg. F., steam to the whole

of the refinery can be controlled. Smaller valves for isolating steam from any individual section of the production plant, are situated at strategic points around the site.

Boiler feedwater supply is piped to the Whitegate site from Ladysbridge, some 10 miles distant, and is treated by a John Thompson-Kennicott water-treatment plant designed for a normal flow of 12,000 gal./hr. This equipment consists of alkaliminator, scrubber tower, and sodium base-exchange. First, for the conversion of temporary hardness into carbonic acid, the water passes through a bed of special resin to the scrubber tower, which has an opposing (upward) flow of air. This air scrubs away the CO_2 from the water, which finally passes through the sodium cycle base-exchange section for the removal of the remaining permanent hardness. This type of plant produces a water having zero hardness and an alkalinity of approximately 10 p.p.m. introduced by the addition of a small quantity of caustic soda before the water reaches the base-exchange section of the plant. In this manner, the CO_2 remaining after scrubbing is neutralised and the pH is raised to eight. The temporary hardness removal unit (alkaliminator) is regenerated with sulphuric acid and the base-exchange unit with salt solution. To remove the dissolved oxygen from the boiler feedwater a John Thompson-Kennicott pressure-type de-aerator, operating at 15 lb./sq. in. and at 250 deg. F., is employed. Possessing a capacity of 132,000 lb./hr. the de-aerator removes the dissolved oxygen to below 0.005 c.c. per litre.

The complete steam-raising plant at Whitegate is pneumatically controlled from a centrally-situated compact control room where comprehensive instrumentation provides minute information of every change in the plant's performance. The Lummas Co. Ltd., of London, were the main contractors for the steam raising plant.

PRESSURE VESSELS and HEAT EXCHANGERS

A new works for the production of pressure vessels, heat-exchangers and similar plant has been brought into operation by Steels Engineering Installations Limited, Crown Works, Sunderland, a member of The Steel Group of Companies. Basically, the new manufacturing facilities have been provided to meet the needs of the petroleum and chemical industries, but their range and capacity will be suitable to the requirements of several other industries including, marine, electricity supply, process industries, pharmaceutical and fine chemicals, gas-production, dry-cleaning and laundering, etc.

The works comprise three main production bays, two of which run parallel, while the third lies at right-angles and across the end of the other two. The larger of the two parallel bays, which is 150-ft. long × 40-ft. wide, is designed and laid out for preparing plates, for pressure-vessels and heat-exchangers, and in the adjacent bay, which is 150-ft. × 30-ft., tube bundles and smaller parts for heat-exchangers are assembled or fabricated. In the right-angle bay, which is higher than the other two, assembly, welding and testing are carried out. A template shop, and a gas-fired stress-relieving furnace, 54-ft. × 23-ft., adjoin the assembly bay, and within this shop is a dark room for dealing with X-ray film processing. Both the low bays are equipped with 10-ton overhead travelling cranes, the gantries being cantilevered into the high bay. In addition, an extended gantry enables the crane to travel out over a steel stock area, 60-ft. × 40-ft. To assist in plate handling within the shops, the two parallel bays are equipped with four 1½-ton jib cranes. Two 20-ton overhead travelling cranes serve the high bay, the gantry being cantilevered at one end to enable direct loading of finished products on to either road or rail vehicles. Machines of conventional type installed in the plate preparation bay enable cutting, edge-planing, edge-setting and plate rolling to be carried out ready for assembly and welding. The oxy-acetylene cutting machines are capable of cutting any thickness of mild-steel plate at speeds varying between 6-in. and 18-in./min., depending on the steel thickness. With iron powder dispensers fitted, they are also able to cut stainless-steel up to 7-in. thick at speeds between 6-in. and 24-in./min. The shop is equipped with a "Tru-Edge" plate edge planer which can handle plates up to 35-ft. in length. This machine can cut all welding profiles and bevels required by all Class 1 vessels in accordance with British, American, and Continental standards. Edge setting is performed on a 900-ton hydraulic press, which is also used for curving small reinforcing rings for nozzles and making cleats and brackets from plate. All welding and assembly operations are carried out in the assembly bay. Depending upon the type of metal and other requirements, welding can be done by any of the three main processes—submerged arc, open arc, or inert gas shielded. Full facilities and experienced technicians are available to carry out X-ray inspection, and a well-equipped metallurgical laboratory is also available.

Mr. C. W. A. Priest, B.Sc. (Eng.), A.M.I.Mech.E., M.I.E.E., has been appointed chief design and construction engineer of the Central Electricity Generating Board in succession to **Mr. E. S. Booth,** M.Eng., M.I.Mech.E., M.I.E.E., who, as recently announced, was appointed a full-time member of the Board. Mr. Priest has been chief project engineer of the Northern Project Group since the formation of these Groups by the Board in January, 1958. In 1923 he joined the London Electric Supply Corporation as an assistant engineer at Deptford power station, where, subsequently, after the station was taken over by the London Power Company, he became turbine house engineer. He was turbine and electrical operating superintendent at Fulham power station for three years until 1939, when he took a post with the Battersea Borough Council as chief assistant engineer, later becoming deputy general manager and engineer. With the reorganisation of the electricity supply industry in 1948, he became generation engineer (construction) of the Southern Division of the then British Electricity Authority, and five years later was appointed chief generation engineer (construction) of the South Wales Division.

* * *

Mr. J. W. Meredith, managing director, Huntington, Heberlein & Co. Ltd. (subsidiary of Simon-Carves Limited) has been appointed a director of Simon-Carves Limited.

Stewarts & Lloyds Limited are manufacturing at their Tollcross Works, 424 control rod standpipes and other components for the reactors at Hunterston nuclear power station. The value of these orders (apart from normal pipework) is stated to be around £300,000. A control rod standpipe is 32-ft. long, comprising 63 tubes welded together, mostly inside the main casing tube. The standpipe is assembled to an overall straightness of 1 in 1,500. Various cavities are filled with high-density barytes concrete to act as biological shielding. Before assembly, standpipe components are cleaned by degreasing, shot-blasting and vacuum-cleaning. The parts are then taken into a special "clean conditions shop" where they are further vacuum-cleaned, dipped in "Trilac," assembled and sealed. Movement is by electric monorail hoists. The clean conditions shop at Tollcross is of dust-proof construction with double-glazed windows, dust-free asphalt floor, rubber-edged doors and is finished with a special metal-free gloss paint. Heated and highly-filtered air is supplied under pressure. These control rod standpipes will control the rate of reaction in the reactor by introducing boron-containing control rods which absorb neutrons. They also lead out of the reactor the burst slug detection tubing which extracts gas samples from each fuel channel for testing for a burst fuel element can. In each reactor there will be over 3,000 of these burst slug detection tubes.

Northern Outfall Works of L.C.C.

THE London County Council's new Northern Outfall sewage plant at Beckton was officially opened on October 22nd, by H.R.H. The Duke of Edinburgh. Costing £9½-million, the new plant—the largest in Europe—is the most expensive single project undertaken by the L.C.C. during the 70 years of its existence. It comprises an activated sludge plant, a sludge digestion plant and a power plant incorporating alternators and blowers driven by gas turbines utilising gas from the digestion plant as fuel. This latter feature distinguishes it from all other sewage works in the United Kingdom—if not in the world. The main contractors for the power plant buildings and equipment were:—Richard Costain Limited—civil engineering work; Demolition & Construction Co. Ltd.—building work; Ruston & Hornsby Limited—main plant; and English Electric Co. Ltd.—electrical plant and equipment.

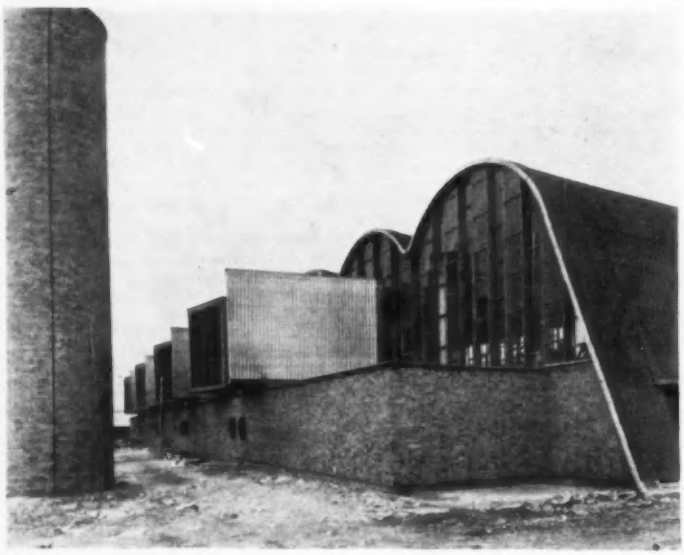
The two main services provided by the power plant are the supply of a continuous flow of air to the diffused-air plant for the activation of the sewage; and a continuous supply of heat for the covered primary sludge digestion tanks, which are the source of the sludge gas—a mixture of 70 per cent. methane and 30 per cent. carbon dioxide—on which the gas turbines are run. To maintain the activation process at maximum efficiency requires some 100,000 cu. ft./min. of free air, while to drive the pumps, scrapers, penstocks, power plant auxiliaries and other associated equipment the power plant must generate 1,865-kW of electricity. The primary digestion tanks need between 20-million and 30-million B.Th.U./hr., according to the season, to maintain a sludge temperature of 85 to 90 deg. F. When the scheme is in full operation the digestion tanks will yield approximately 2,700,000 cu. ft./day of sludge gas.

The power house is a concrete structure, 300-ft. long, 100-ft. wide and 40-ft. high, with glass end-walls and a multi-arch shell roof constructed of pre-cast sections. The eight Type-"TA" gas turbines each rated at 960 h.p., and of the open-cycle, two shaft type were supplied by Ruston & Hornsby Limited and are installed in a single line down a turbine hall running the full length of the power house at ground level. Five of the turbines are directly coupled to air blowers, and three drive alternators through 4:1 reduction gear of the epicyclic type supplied by W. H. Allen Sons & Co. Ltd. Each turbine is provided with its own console and, when running, can be controlled from the console or from a control room, a glass-fronted structure within the power house from which the operator commands an ininterrupted view of the turbine hall.

Starting of the turbines is by battery-powered electric motor. Incoming air, compressed by a 13-stage axial flow compressor, passes through a heat-exchanger, then to the turbine combustion chamber where it is mixed with fuel and burned. Combustion gases pass through a two-stage compressor turbine, then through a two-stage power turbine, again through the heat-exchanger (by different channels), through a water-heater and, finally, by underground ducting to one of five brick chimneys. The heat-exchangers are 20-ft. long, have a body dia. of 8¼-ft., and weigh 45-tons. They are constructed on the two-flow principle, each incorporating 4,080 tubes of 1-in. outside dia., and providing a heating surface of approximately 11,840 sq. ft. Although sludge gas is the normal fuel, diesel or fuel oil can be used as an alternative, the necessary storage facilities being provided.

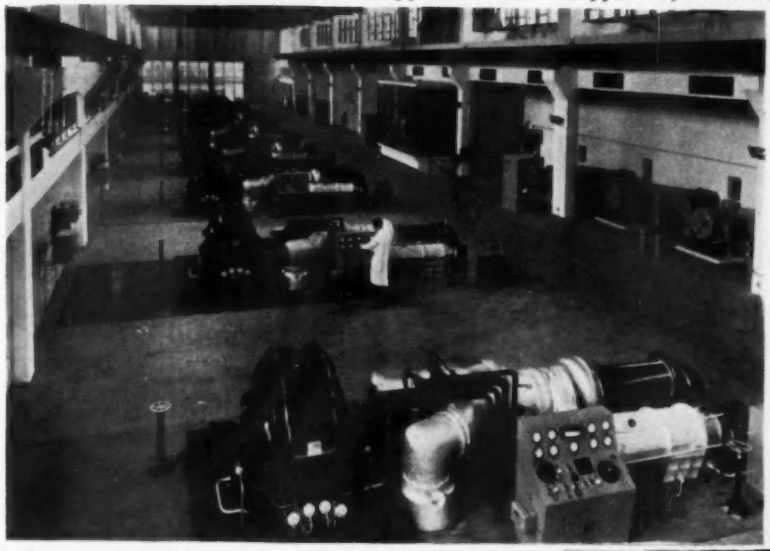
A basement, which also runs the full length of the power plant building, houses the heat-exchangers and water-heaters associated with the turbines, the oil- or gas-fired supplementary water-heaters, and some of the power house services. On the upper half of the south face of the power house are eight angled filter-chambers and, separate from the building, but in close proximity on the south side, are the five chimneys which carry the turbine exhaust to atmosphere.

The five air blowers supplied by Reavell & Co. Ltd. are of the single-stage, double-entry centrifugal type, directly coupled to the turbines, each being designed for a rated output of 25,000 cu. ft./min. of free air at a pressure of 7½ lb./sq. in. at 6,000 r.p.m. Pressures up to 8½ lb./sq. in. can be obtained if necessary. Four of the blowers can supply the air needed for the activation process, one acting as standby. Air for the blowers, and



The south side of the Northern Outfall works power house building, showing the eight angled filter-chambers, and part of one of the five chimneys.

the 115,850 cu. ft./min. required for the gas turbines, is passed through electrostatic filters supplied by Sturtevant Engineering Co. Ltd., and installed in six of the eight filter chambers mentioned previously. Both blowers and turbines obtain their air supplies from a gallery running the length of the power house, which the air enters on leaving the filter chambers. Special equipment is provided in the basement for the periodic cleaning of the filters.



(Left). A view inside the turbine house, showing the eight type "TA" gas turbines supplied by Ruston & Hornsby Limited. On the right can be seen the 180-h.p. motors, supplied by the English Electric Co. Ltd., for driving the gas compressors. In the centre is the glass-fronted control room.

(Below). A close-up of the control room. All necessary instruments are provided to give complete information on operating conditions throughout the plant.

The three alternators, supplied by the English Electric Co. Ltd., are each rated at 750-kW, but will normally deliver 620-kW at a p.f. of 0.8 at 3.3-kV at 1,500 r.p.m. If required, power up to a maximum of 2,000-kVA can be taken from the L.E.B. supply. Power from the alternators is fed via a 13-panel h.t. switchboard in the control room to two 500-kVA, 3.3-kV/415-V transformers. The board has a double busbar unit and a rupturing capacity of 100-MVA. It comprises three alternator panels, two auxiliary station transformer feeders, five 180 h.p. compressor motor panels, two ring main isolators and one busbar coupler.

Sludge gas is delivered from the digestion tanks to the power house through an 18-in. main, and under a slight pressure. From the main it passes to two-cylinder, two-stage, double acting, intercooled compressors, supplied by Reavell & Co. Ltd., each with a capacity of 750 cu. ft./min. which, after increasing the pressure to 120 lb./sq. in., pass the gas to two 1,050 cu. ft. capacity receivers. The compressors, which are housed in a separate compartment adjoining the turbine hall, are driven by 180-h.p. English Electric induction motors by means of a V-belt reduction drive and a sealed shaft through the wall. They come into operation, or are off-loaded automatically, as demand rises and falls. Altogether five compressors are installed, three of which can meet the normal demand for gas.

Hot-water and cooling-water systems

The water heaters are each designed to extract 3,100,000 B.Th.U./hr. from the exhaust gases of the turbines, thus providing a total of 21,700,000 B.Th.U./hr. under normal conditions from seven working turbines. The water is heated to a temperature of 165 deg. F., and is circulated through the heaters, 12-in. mains and sludge coils by one of two electrically-driven centrifugal pumps supplied by Worthington-Simpson Limited. The hot-water system is pressurised by a large surge-tank, part of the supply being used for space heating and domestic purposes in the power house and for the heating coils in the main fuel-oil storage tanks.

Cooling-water for the turbine lubricating oil, gas compressors and other purposes is drawn from a cooling-water pond and circulated by an electrically-driven centrifugal pump manufactured by Ruston & Hornsby

Limited. The water is returned to the pond through cooling sprays.

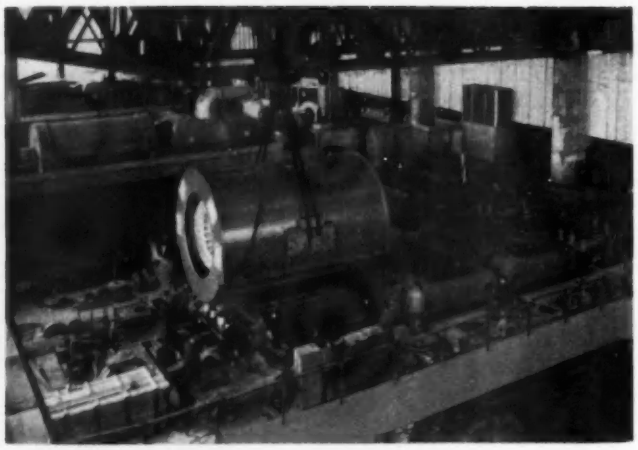
The main contractor for the supply and fitting of thermal insulation at the Northern Outfall works was The Cape Asbestos Co. Ltd. Insulation on all the Ruston and Hornsby gas turbines and all ancillary pipework and ducting was "Rocksil" medium density slabs and "Caposite" blocks, finished with hard setting cement. The heat-exchangers were insulated with "Rocksil" slabs. The insulation of all service piping installed by G. N. Haden and Sons Ltd. was carried out in "Rocksil" rigid pipe sections.

Control and instrumentation

All necessary instruments are provided to give complete information on plant operating conditions; the principal instruments and controls being housed in the control room. The controls include a main electrical panel for the remote operation of the 3.3-kV and 415-V switchgear, alternators and gas compressor motors. This panel is complete with a mimic diagram which gives immediate indication of the switching arrangements and plant in service.

Instruments associated with plant performance are all of the recording type. Kelvin & Hughes (Industrial) Limited were responsible for the overall instrumentation, individual items being supplied as follows:—International Gas Detectors Limited—methane gas detectors; Cambridge Instrument Co. Ltd.—oxygen detector; Elcontrol Limited—turbine flame-failure equipment; and James Gordon & Co. Ltd.—CO_2 recorder.

Fire protection within the greater part of the power plant building is provided by "Mulsifyre" water-spray equipment supplied by Mather & Platt Limited, which is associated with a diesel engine-driven pump designed to deliver up to 1,250 gal./min. at a pressure of 100 lb./sq. in. The gas compressor room is fitted with a carbon dioxide system supplied by the Pyrene Co. Ltd. A fire annunciator panel is provided in the control room covering both systems, and either system can be operated manually at the scene of the fire or remotely from the control room.



The A.E.I. Turbine-Generator Division is supplying a number of 120-MW reheat steam turbo-generators to C.E.G.B. power stations. All these machines will be three-cylinder, tandem-compound turbines driving hydrogen-cooled generators, designed to operate with initial steam conditions of 1,500-lb./sq. in., 1,000 deg. F., and reheat steam at 1,000 deg. F. Two of these sets have now been commissioned at Blyth "A" power station, and our illustration shows the generator stator for the third unit being placed in position. When completed, the plant installed at Blyth "A" will comprise four 120-MW turbo-generators and four boiler units supplied by Babcock & Wilcox Limited, each with a capacity of 860,000 lb./hr., at 1,500 lb./sq. in. and 1,000 deg. F., with reheat to 1,000 deg. F. A.E.I. are supplying eleven generating sets of 120-MW rating, viz., two for Agecroft "B," three for Staythorpe "B," and two for Padiham "B."

HARWELL REACTOR SCHOOL

The third reactor school course on the control and instrumentation of reactors will take place from February 1st to 12th, 1960, inclusive, and will be open to British and overseas students. It will be held at Durley Hall, Bournemouth, Hants. The course is primarily intended for those who have a direct interest in the control and instrumentation of nuclear reactors, and it will be assumed that participants have some knowledge of the basic principles of these subjects. The topics to be treated will include:—elementary reactor physics; revision of elementary reactor kinetics, control and instrumentation; automatic control of reactors and nuclear power plants; application of computers; reactor transfer functions and function analysers; neutron counting equipment; neutron flux detectors; neutron flux scanning; radiation detectors and their siting in reactors; reactor safety circuits; conventional instrumentation; use of transistors in reactor instrumentation; burst slug detection; design of control mechanisms; spatial instabilities in reactors; data reduction problems on large reactors. In addition to the lectures, there will be visits to zero energy and high flux research reactors and other relevant parts of the Harwell Establishment. The fee for the course will be fifty guineas, exclusive of accommodation, and application forms, available from the Reactor School, must be returned by December 11th, 1959, to:—The Principal, Reactor School, Atomic Energy Research Establishment, Harwell, Didcot, Berkshire.

W. H. ALLEN SONS & CO. LTD.

What may be one of the biggest mass presentations of long-service gifts and awards ever to be made by an industrial firm in the United Kingdom, commenced at **W. H. Allen Sons & Co. Ltd.**, Bedford, on Wednesday, October 28th. The presentations continued on Thursday and Friday, October 29th and 30th, and again on Monday, Tuesday and Wednesday, November 2nd, 3rd and 4th, culminating on the Wednesday evening when 45 employees and senior members of the firm met at a special dinner to celebrate their having been in the firm's service for 40 years or more in the case of women, and 45 years or more in the case of men. In all, the number of gifts presented totalled 415. In a short speech at the beginning of the ceremonies the chairman of the company, **Mr. W. Kenneth G. Allen,** stated that the scheme is not a new one as far as the firm is concerned, but that it is an improved scheme to recognise the completion of 25, 35 and 45 years' service by men, and 25, 35 and 40 years by women.

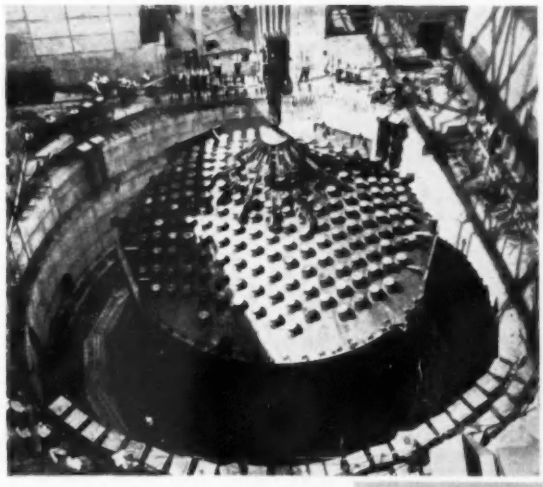
* * *

Keith Blackman Limited have issued a folder in order to clarify in the minds of potential and actual users of "Tornado" centrifugal fans, blowers and exhausters, the various standard directions of discharge available. This publication is available to those interested, from the Publicity Department of the Company at Mill Mead Road, London, N.17. (Telephone: Tottenham 4522, Ext. 310.)

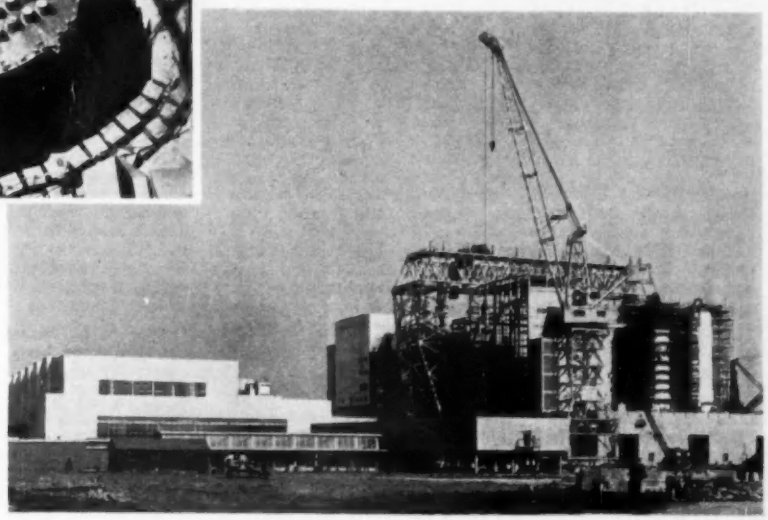
Progress at Bradwell

DURING the latter part of May, 1958, the first of 12 heat-exchangers for the nuclear power station, now under construction at Bradwell, Essex, by the Nuclear Power Plant Company, was launched into the River Tees near the works of the manufacturers, Head Wrightson & Co. Ltd. (a member firm of the N.P.P.C.), and towed by tug to Bradwell. There, a concrete slipway had been constructed, down which a road low-loader was run and the vessel floated into position above the vehicle. As the tide fell, its weight was taken on the loader which was then hauled from the river by powerful tractors and transferred to the nearby power station. On October 20th, 1959, we visited the site to witness the arrival of the last of these heat-exchangers, after it had undergone a similar journey.

The 12 units were each fabricated from 1 $\frac{9}{16}$-in. thick plate, and are 19-ft. dia. over the major portion of their length, with a 20-ft. dia. section at the base. The overall height of each shell is 92-ft. 4$\frac{1}{2}$-in., and the weight 200-tons. Tubes within the heat-exchangers are grouped in three banks (economiser, evaporator and superheater), and the steam conditions at the outlet of the superheater will be: low-pressure 87,500 lb./hr. at 210 lb./sq. in. and 704 deg. F.; high-pressure 170,833 lb./hr. at 770 lb./sq. in. and 704 deg. F.



(Above). The top cap of the No. 1 reactor pressure vessel being lowered into the reactor prior to welding into position.



(Right). A general view of the Bradwell site showing (right) the reactor buildings straddled by the Goliath crane, and (left) the turbine house.

When completed, the station will have a guaranteed nett output of 300-MW; two natural uranium, carbon dioxide gas-cooled, graphite-moderated reactors being provided to supply heat to the six boilers associated with each reactor. Carbon-dioxide gas at a pressure of 142 lb./sq. in. will be circulated through the reactor core and heat-exchangers by single-stage axial blowers—one for each boiler. The blowers are designed for a speed range of 600 to 3,000 r.p.m. and are electrically-driven, the power supply being obtained from two of three auxiliary turbo-alternators, each rated at 15.2-MW and running at 3,000 r.p.m.

Progress to date

At the time of our visit to Bradwell the building for No. 1 reactor was complete. The spherical pressure-vessel had been stress-relieved and was due for pressure testing. After the pressure test, the standpipes for reactor charge and control will be installed, and preparations made within the vessel for the laying of the graphite core. Above the vessel, in the area known as the pile cap, the gantry for the charge/discharge machine had been positioned, and was awaiting the arrival of the two charge machines. The pile cap crane had also been installed. Five of the heat-exchangers associated with No. 1 reactor are fully tubed, the last one being almost complete, while five of the six blowers have passed their running tests. In the reactor control rooms, the burst-slug detection equipment and upper control rod gear are installed.

The building for No. 2 reactor is less complete. In the early part of November, the top cap of the pressure vessel was due to be lifted into the reactor and welded into position. This will be followed by the thermal dome. Five of the six boilers have been installed and the tubing of these is in hand. Work is proceeding on the blowers, in the control rooms, etc., and the gantry for the charge/

discharge machine will be fitted in the near future.

A cooling pond, common to both reactors, and used for the temporary storage of irradiated fuel elements, is being constructed at the east side of the reactor building; the civil work on this facility is now 85 per cent. complete.

The turbine house is structurally complete, and the first of the six main turbines has been installed, while the second was awaiting the arrival of its l.p. spindle. Three main and one dump condenser have been installed. In the auxiliary turbine house, the first condenser has been installed and is being tubed. The station control room was being equipped with panels and control desks; while the diesel house, battery room and water-treatment plant are completed.

The circulating-water system, which will supply cooling from the Blackwater Estuary to the turbine condensers, comprises a pumphouse, distribution and return systems and an offshore barrier wall with inlet and outlet coffer dams. All this work is nearing completion.

Among the auxiliary plant items, the CO_2 storage plant, at the north-east corner of No. 1 reactor building is almost complete, and at the south end of the site, the switchyard is receiving incoming electricity for station requirements.

(Left). An aerial view of the Bradwell site. In the foreground can be seen the barrier wall, with inlet and outlet coffer dams, in the Blackwater Estuary.

CORNER-TUBE BOILERS

Newton Chambers & Co. Ltd., Thorncliffe, Sheffield, have entered into a licence agreement with Corner Tube Boiler Co. Ltd., of Manchester, for the production and sale of corner-tube boilers in Great Britain. The use of these boilers will extend the application of the Redfyre Emma coke-fired central heating boiler from hot water and low-pressure steam to the higher pressure steam and hot water requirements of large buildings, hospitals and industry. Babcock and Wilcox Limited, who already manufacture corner-tube boilers in this country, will continue to do so, dealing with the very large boilers for steam-raising, while Newton Chambers provide the hot water systems and medium size high-pressure steam boilers. For some 18 months Newton Chambers have held a licence from Bronswerk N.V., of Holland, for the manufacture of the Emma boiler, which is of unique design with a high thermal efficiency of around 85 per cent. The Emma unit is claimed to effect a saving of 20-25 per cent. on fuel costs compared with ordinary types of coke-fired boiler. The Emma system of coke-firing is ideally suited to the corner-tube boiler, which embraces a special tubular heat-exchange system which makes it capable of working at high pressures, and generating high-pressure steam. Here also, efficiencies of 85 per cent. can be maintained for long periods when running under varying loads. Considerable interest has been shown in the Redfyre Emma boiler in this country, and orders for about twenty such units have been received already by Newton Chambers & Co. Ltd. For demonstration purposes, and to accelerate early installation, boilers have been imported from Holland, but future installations will be made at Thorncliffe. Details of the corner-tube boiler issued by the company show that it dispenses with the need for an external skeleton of structural steelwork, by relying upon the heavy downcomers at its corners to support the tube banks. This form of construction provides a lighter and less expensive boiler than any other supplied so far in a range of steam outputs from 230 up to 330,000 lb./hr., at steam pressures up to 1,000 lb./sq. in. The lower range of these boilers, from 230 to 11,000 lb./hr., has been standardised, and on certain installations, arranged as a "packaged" boiler. Corner-tube boilers are of completely-welded construction, a method which facilitates large-scale prefabrication.

300-MW SETS BY A.E.I. LTD.

A contract approaching £5 million in value, and for the supply and erection of two 300-MW turbo-generator units, complete with feed-heating equipment, is being placed with the turbine-generator division of **Associated Electrical Industries Limited,** by the Central Electricity Generating Board. These machines are to be installed at West Thurrock, power station now under construction in the Eastern Division of the C.E.G.B. The station will have an installed capacity of 1,000-MW, and when in full operation, the coal consumption will be approximately 3½-million tons per year. Each generating unit, which will have the greatest single-line output in the world at 3,000 r.p.m., will consist of a four-cylinder turbine directly-coupled to the generator; the exciters are to be gear-driven from the generator shaft. Seven stages of feed-heating will be employed, giving a final feed temperature of 485 deg. F. Inlet steam conditions will be 2,300 lb./sq. in., and 1,050 deg. F., at the turbine stop-valve. After expansion through the high-pressure stages, the steam will be re-heated to 1,050 deg. F. before entering the intermediate-pressure cylinder, from whence it will be taken through four overhead pipes to the two double-flow low-pressure cylinders. The generator will produce 50 c/s, three-phase a.c. at 16,500 volts, operating at 0.85 p.f. The stator windings will be direct water-cooled (a system first introduced by A.E.I. engineers) and the rotor windings will be direct-cooled by hydrogen at a pressure of 30 lb./sq. in. The turbines and generators will be manufactured at the Trafford Park Works of A.E.I. Turbine-Generator Division, and the heat-exchange equipment at A.E.I. Germiston Works, Glasgow.

* * *

Mr. A. E. Nixon, director of the Darlington Insulation Co. Ltd., has been appointed managing director (sales) of that company, which is a member of the Darlington Group of Companies. Mr. Nixon will continue to operate from 5, Petty France, London, S.W.1.

* * *

Mr. A. F. Brittin, B.Sc., hitherto sales engineer, has been appointed sales manager of the Power Plant Department of the Superheater Co. Ltd., 97 Tottenham Court Road, London, W.1.

RECENT Equipment AND Accessories

A new principle of automatic stoking

Modern trends in steam raising are towards automatic firing, increased efficiency and reliability, clean operation, and the ability to burn the most economical and readily available fuels. Each of these aspects has been taken into account in the design of the G.W.B.-Vekos automatic stoker, recently introduced to this country by G.W.B. Furnaces Limited, and in which the coal is burned in a water-cooled combustion chamber; the hot gases being directed into the boiler to which the stoker is fitted. A screw-type conveyor with a specified hourly throughput carries the coal to the top of the combustion unit, dropping the fuel into the Vortex chamber where it is made to spread evenly in a thin layer on the fire-bed. The total combustion-air is divided into three separate quantities and introduced to the furnace in three different positions so as to assist in providing a high combustion efficiency. Primary air is directed underneath the grate in which the passages provide high resistance to the air flow, maintaining an even air pattern through the fire. Secondary air is directed over the hearth through a duct set tangentially in the Vortex chamber, whilst the tertiary air is supplied at the throat between the stoker and boiler. Each amount of air is set for optimum conditions and is provided by a common fan. The three dampers governing the various air flows are adjusted and pre-set correctly in relation to each other, and during operation are controlled from one master damper. The fan, and screw conveyor, are controlled through either a temperature or steam pressure regulator depending upon whether the boiler is arranged for water heating or steam raising. When the required temperature or pressure is reached, the air and the fuel rates are automatically reduced to suit the load. When extra output is required, the air and fuel are again automatically adjusted to meet the increased requirements. This method of operation is claimed to maintain a high combustion efficiency, thereby effecting a saving in fuel. Since the water used in the stoker cooling system is connected to the boiler itself, the manufacturers say there is a resulting increase in generating capacity which may be up to 20 per cent., depending upon the type of boiler. The new stoker has been designed to burn all types of bituminous fuels, including strongly caking coals, and units have been successfully used in tropical countries, burning nut shells and husks left over after extraction of vegetable oils. Small coal may also be burned, although it is advisable, in order to guarantee maximum efficiency, that the amount of fines below ¼-in. should not exceed 35 per cent. and that the moisture content limits should be around 15 per cent. The upper fuel size would be in the order of 1-in. The special coal feed arrangement is designed to produce an even fire-bed, and it is claimed that a consistently high CO_2 value of 14-16 per cent. is obtained under normal operation, without producing smoke. Infiltration of air into the side passes, as, for example, with a brick-set boiler with induced-draught, is considerably reduced, since the air supply to the G.W.B.-Vekos stoker can be pressurised to off-set the slight back-pressure of the economiser, superheater, etc. resistances. In such cases it is normally necessary to break the natural chimney draught. Maintenance of the G.W.B.-Vekos stoker is extremely simple; raking of the fire-bed is not necessary. The furnace bed is cleaned occasionally, the frequency depending on the ash content of the fuel. The stoker does not employ a moving grate, and in the absence of any moving parts in the combustion chamber, problems of wear and tear in this respect do not arise. Two methods of electric control are available, the first of which includes an "on-off" control whereby at a pre-determined boiler pressure or temperature, the unit is switched on or off. Should the periods when the stoker is switched off be excessive, the unit is simply adjusted to a lower level of working. The other method functions by means of "high-low" control. This employs a screw conveyor motor having two

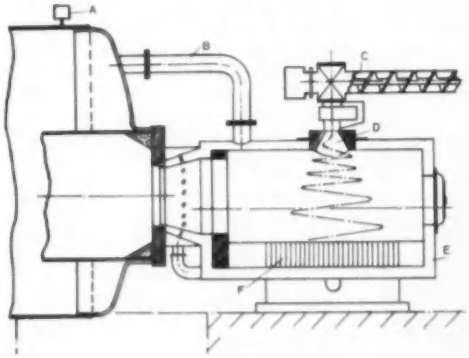


Fig. 1 (left). Diagrammatic cross-section of the G.W.B. Vekos stoker as fitted to the front of a boiler. A. Temperature or pressure regulator. B. Water connection. C. Screw conveyor. D. Vortex chamber. E. Water-cooled combustion chamber. F. Fixed grate.

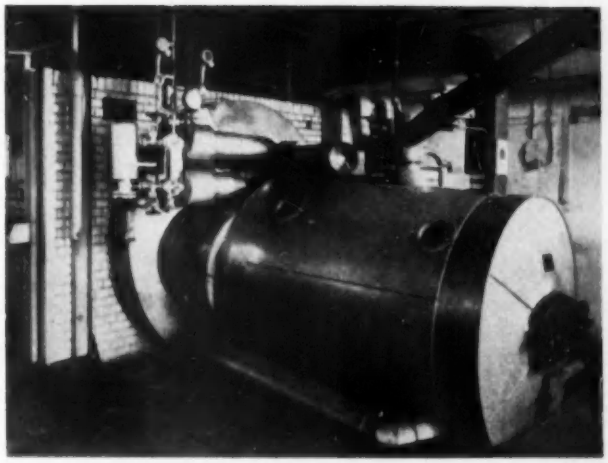


Fig. 2 (right). A Vekos stoker fitted to a 30-ft. by 8-ft. diam. Lancashire boiler.

speeds. Instead of the stoker being switched off at a pre-determined boiler pressure and temperature, the gear-box is changed to a lower speed and the air quantity is automatically controlled to give a constant fuel-to-air ratio. When the steam pressure or temperature drops, the unit is then switched back to normal maximum. This control is effective down to 50 per cent. of the total capacity of the stoker. The G.W.B. Vekos stoker can be used in conjunction with almost any type of boiler, whether water-tube or fire-tube, and is manufactured in single units with capacities ranging from 165-770 lb./hr. of coal. Where required, twin stokers may be fitted, thus doubling the fuel-handling capacity up to a maximum of 1,540 lb./hr. (*G.W.B. Furnaces Limited, P.O. Box No. 4, Dibdale Works, Dudley, Worcs.*)

Flow recording chlorinator

The newly designed chlorinator available from Chlorination Equipment Limited is now available with an integral flow recorder. This combination of chlorinator and flow recording instrument, while saving space and avoiding trailing connections between the units, is claimed to result in an improved efficiency by eliminating the losses which can occur from remote mounting of the recorder. The recording unit, installed in the head of the equipment, is provided with a glass panel of ample proportions, which opens to allow easy access to the unit without interfering with the chlorinator. The recorder operates from the metering differential, which is transmitted to coupled bellows, and is obtained by connections across a specially-designed valve inserted between the vacuum regulator outlet and the meter inlet. The vertical movement of the bellows coupling controls the pen-driving mechanism. A continuous recording is provided on the seven-day drum chart which is calibrated in lb./hr. of chlorine, and which displays a generous area to facilitate the observation of past readings. The drum is operated by an eight-day clockwork mechanism. The cabinet is fabricated from polyester-impregnated glass fibre and thus requires no repainting. The most important components of the chlorinator, such as the injector block, chlorine regulator, valve body and piping, are made from plastic materials which have been specially developed for their chlorine- and water-resisting properties. Corrosion-resistant alloys are used where metal parts are unavoidable. To enable the operator to alter the capacity of the instrument, the chlorine flow-meter and the control valve stem and sleeve assembly are situated in an easily accessible position, as indeed are all the major components. The new unit is manufactured in two types:—type NMF for manual operation, and type NAF for fully-automatic dosing; each type being available with 13 meter sizes ranging from maximum capacities of 0.125 to 40 lb./hr. of chlorine with a control range of 10 to 1. A supply of charts, sufficient for two years' operation, calibrated according to capacity is provided with each instrument (*Chlorination Equipment Limited, 129, Kingsway, London, W.C.2.*)

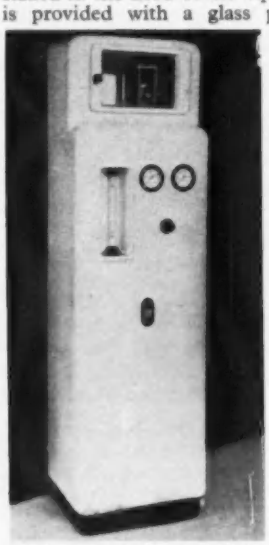


Fig. 3 (left). The newly-designed flow recording chlorinator is available as either a manually-operated or fully-automatic unit. (Chlorination Equipment Ltd.)

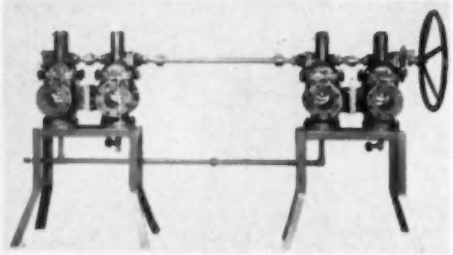


Fig. 4 (above). The Charlton changeover valve for use with oil-coolers in a turbo-generator, provides two opening and closing actions with one movement of the control wheel. (R. Blackett, Charlton & Co. Ltd.)

Changeover-Control-Valve for oil-coolers

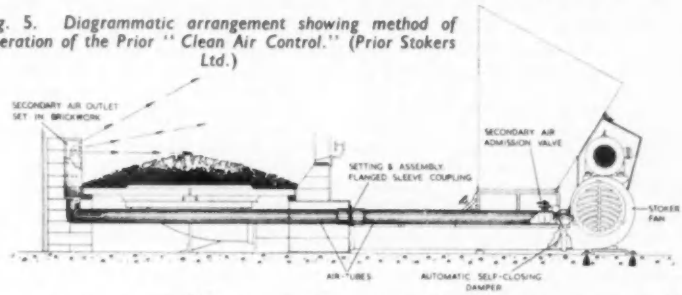
A new changeover-control-valve designed and manufactured by R. Blackett, Charlton and Co. Ltd., following an original request by C. A. Parsons and Co. Ltd., for use with oil-coolers in a turbo-generator, provides two opening and closing actions with one movement of the control wheel. The requirement was for a valve which would ensure beyond doubt that the second stand-by oil cooler would come into operation before the one in service was shut off. This means that there can be no risk of damage to the turbo-generator by both coolers inadvertently being shut off at the same time. The Charlton changeover-control-valve (patent applied for) has eight wedge-gates in four valves, all operated by one control wheel and shaft, actuating a rack and pinion in each valve. As the four wedges controlling the supply of water and oil to the first cooler are being closed, the four opposite wedges are simultaneously opening. There is no time lag in the operation, and, therefore, no danger to the turbo-generator. A special spring adjustment mechanism is incorporated in each valve to ensure that the wedges open and close fully. The body of the valves for both oil and water are all cast-iron while the wedges on the water side are of stainless-steel, and gunmetal on the oil side. Although the valve was designed for a particular application it is, the company suggest, suitable for use in a wide range of operations involving cooling circuits. (*R. Blackett, Charlton & Co. Ltd., Manor Works, Newcastle upon Tyne.*)

Smoke control unit for Prior Underfeed stokers

Prior Stokers Limited have issued particulars of a device which they have introduced to deal with possible smoke nuisance with Prior Underfeed stokers, when operating under conditions which may lead to this. The device in question, known as the "Clean Air Control" has been designed as the result of lengthy tests carried out at the Prior works, with the object of providing a method of dealing with undue smoke emission, that was simple and not expensive, and that could be fitted to both new and existing Prior stokers. In their reference to the new device, the company point out that almost balanced-draught conditions in the combustion chamber are usually required for the most efficient results with underfeed-stoker-firing. Such conditions are provided by regulating the fan draught for the amount of coal passed to the retort of the stoker and its burning characteristics, with suitable stack damper adjustment for the proper evacuation of the gases. When this

is so there is smokeless combustion. Thermostatic control of the stoker is, however, likely to cause periods of inactivity and such intermittent use may adversely affect these satisfactory conditions. When the stoker initially functions, the fan draught may have difficulty in uniformly penetrating the incompletely incandescent firebed. At the time it ceases to operate, the Prior automatic air seal immediately cuts the air supply to the retort. This occasionally results in partially burnt gases, also owing to lack of oxygen, being drawn through the fire-bed by chimney suction for a short period. In either case there may be a temporary tendency for undue smoke, which cannot be dealt with when there is start and stop operation of the stoker. The Prior Clean Air Control is designed to work both with, and independently of, the action of the stoker in order to deal with smoke nuisance. It will also assist the efficient combustion of low-grade and heavily-caking coals and thereby add to the fuel economy, which is possible with the underfeed principle of mechanical firing. With it, a limited amount of secondary-air is diffused from a place at the upper part of the refractory brickwork adjacent to the retort. This secondary-air is directed towards, and over the top of the firebed so that it will mix with the products of combustion as they pass to the outlet flue. Fans fitted to Prior stokers have an ample supply margin, and only up to some 10 per cent. of the total capacity is taken for the secondary-air, which enters a tube at a point near the fan, to ensure the best velocity. In its passage, the air is warmed to obtain the most satisfactory mixing effect in the combustion chamber. The heat from the fire will quickly establish an increased chimney suction, so that if the stoker is stopped by thermostatic control, air will be drawn into the combustion chamber. To take advantage of this, the secondary-air pipe is open to atmosphere at its entry, and its diameter is such that it will allow for a suction of from 0.1 to 0.25-in. w.g. depending upon the size of the stoker. As a result, any partly burnt gases from the retort receive the oxygen supply needed for clean and complete combustion under all conditions. The secondary air admission has an additional benefit when the stoker is idling, as it counteracts any tendency for the fire to burn down into the retort through incorrect operation, with the possibility of damage to it. Whether the stoker is in operation or not, the amount of air from the secondary-air outlet in the combustion chamber can be easily varied and set for the requirements. There is consequently no loss of efficiency due to excess air when the firebed conditions are as needed for the normal heat output from the stoker. There is at all times a degree of air turbulence in the combustion chamber and any tendency for smoke emission, for however short a time, is countered. (*Prior Stokers Limited*, 1-3 *Brandon Rd., York Way, London, N.7.*)

Fig. 5. Diagrammatic arrangement showing method of operation of the Prior "Clean Air Control." (Prior Stokers Ltd.)



Unit air heater

Mather & Platt Limited announce a new unit air heater, the "Thermolier." This new equipment is available in five unit sizes and is designed to operate on steam, low-pressure or high-pressure hot water. The different units cover a thermal output range of between 35,000 and 350,000 B.Th.U./hr., and almost any required output in this range is possible. A thermostat can be fitted into the motor circuit if required. The louvres are individually adjustable to control the direction of the warm air stream and stops are fitted to prevent any excessive movement that might restrict satisfactory air flow. The unit is manufactured from steel sheet on which high purity zinc has been electrolytically deposited to give good resistance to corrosion. Close attention has been paid to the necessity for quiet operation and anti-vibration mountings reduce noise to a minimum. The motor has been specially designed for fan duty and the fan has been designed to match the heat-exchanger so that the quantity and velocity of air give the maximum thermal efficiency. (*Mather & Platt Limited, Park Works, Manchester.*)

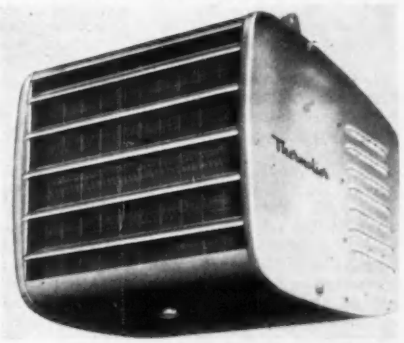


Fig. 6. The new "Thermolier" air-heater, which is designed to operate on steam, low-pressure or high-pressure hot water. (Mather & Platt Ltd.)

Vacuum cleaning plant for U.K.A.E.A.

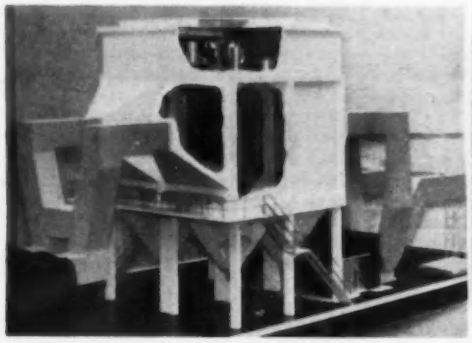
At the recently built Springfields works of the United Kingdom Atomic Energy Authority the handling of toxic dust has required special consideration, and six separate systems have been installed by The British Vacuum Cleaner & Engineering Co. Ltd. These are essentially vacuum cleaning systems designed to remove surface deposits of dust and powder, being notable for their employment of a unique cyclone method, which is claimed to be not only efficient but to ensure disposal of the dust with a maximum degree of safety. Undoubtedly, the most interesting fact about the installations is that, due to the nature of the powders and dusts collected, no accumulation of dust is permitted in any dry state. This condition, of course, precluded the use of conventional dust separators with fabric filters. High-efficiency cyclones which incorporated a unique wetting and dust-arresting feature were, therefore, introduced. Tests have indicated that the collecting efficiency of these units is virtually 100 per cent. The dust, when picked up through the cleaning nozzles, is precipitated in the cyclones and held by the wet sump. This means that the whole of the inter-connecting pipe-work system, which is normally a dust conveying line, is employed purely for the passage of air, being completely free from dust particles. The dust is also collected in sealed boxes in which certain production

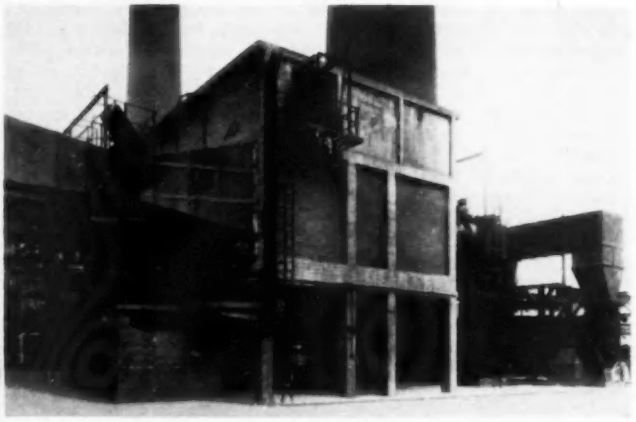
processes are carried out. To handle this problem with the greagest degree of economy of suction power, automatic closing valve tools are actually retained in the boxes, and are handled by operators through glove ports. As a safeguard, secondary cyclones are incorporated in the systems, being located adjacent to the air exhauster units. These para-cyclones are of a very high-efficiency type, comprising multiple units within a single housing above a dust storage receptacle with wet sump. The air exhausted by the B.V.C. units is conveyed to the factory main air extraction ducting. A second vacuum cleaning system has a similar function, but in this case, due to the nature of the powders and dusts handled, the wet sump feature of the primary cyclones gives rise to the development of gas. To overcome this condition and to prevent pressure build-up during operation, explosion vents are incorporated above each primary cyclone. To ventilate each cyclone, the inlets and suction control valves and the outlets are arranged with pilot holes, these ensuring that when the primary cyclone is isolated from the suction lines, there is a small air throughput to disperse any gas accumulation. (*British Vacuum Cleaner & Engineering Co. Ltd., Goblin Works, Leatherhead.*)

At the International Clean Air Exhibition which was held at the Seymour Hall, London, W.1, from October 20th to 22nd, **W. C. Holmes & Co. Ltd.,** featured for the first time among their exhibits a scale model of a Holmes-Elex electrical precipitator of the type installed with pulverised-fuel-fired boilers at industrial and central power station installations. Holmes-Elex electrical precipitators are specifically-designed for the removal of extremely small particles, in the sub-micron range, from all types of carrier gas. The particles, either liquid or solid, are separated by passing the contaminated gas through a high-voltage electrical discharge, which imparts a negative charge to the particles and then deposits them on to collecting plates. The particles are subsequently removed from the collecting plates by various means, depending on the particular application. Since the principle of such plant is of an electrical nature, the cleaning of gases does not rely on the inertia or effective size of the particles, as in the case of cyclone collectors or wet washers, and thus not only do the larger particles deposit, but also those which measure a fraction of a micron in diameter. The accompanying illustration shows one of the four three-section Holmes-Elex electrical precipitators installed for service with the pulverised-fuel-fired boilers at the Billingham works of the I.C.I. Ltd.

(Below). Model of the Holmes-Elex electrical precipitator.

(Right). One of the four Holmes-Elex units installed at the Billingham works of I.C.I. Limited.





Worthington-Simpson Limited announce an addition to their already extensive range of versatile "Monobloc" centrifugal pumps. The new range is designated type "DO," and comprises open-impeller type pumps specially-designed to handle slurries, paper stock, liquids containing small solids, and viscous liquids as well as clear liquids. Capacities of from 10 to 360 g.p.m. and heads up to 86-ft., depending on capacity, are covered by this range of pumps.

* * *

M. A. Boylan Limited, the well-known Irish firm or insulation contractors, were responsible for the insulation work at the new oil refinery at Whitegate, Co. Cork, which was officially opened on September 23rd. This was the largest insulation contract ever carried out in the Irish Republic. The total amount insulated was 74,845 ft., or over 12 miles of piping and approximately 50,000 sq. ft. of vessels, towers, etc. The piping was insulated with "Caposite" amosite asbestos sections, finished with an asbestos based felt. The towers, vessels, etc., were insulated with "Rocksil" mattresses and slabs and finished with aluminium sheeting. M. A. Boylan Limited are recognised specialists in the cleading of insulation with metal and have in recent years developed their own finishing technique, in particular for large tanks. **The Cape Asbestos Co. Ltd.,** London, of whom M. A. Boylan Limited are a subsidiary, supplied all the insulation materials.

* * *

Dr. William H. Wheeler, C.M.G., Ph.D., director of the Explosives Research and Development Establishment, Ministry of Supply, has resigned from Government service, and joined Urquhart's (1926) Limited, combustion engineers and oil-burner manufacturers, as deputy managing director. Dr. Wheeler was educated at Luton Grammar School, St. Catherine's College, Cambridge, and at the Imperial College of Science. He first joined Government service in November, 1937, and has held many important appointments including, Director of Projectile Development from 1945-1950, Director of Guided Weapons Research and Development from 1950-1956, and Head of U.K. M.O.S. Staff (Australia) from 1956 to date.

Disposal of fly-ash from power stations presents considerable problems in many parts of Britain. At the Central Electricity Generating Board's Cliff Quay power station, Ipswich, for example, the total daily output of fly ash is up to 500-cu. yd. at peak periods. The total amount of ash in the lagoons surrounding this station is estimated to be in the neighbourhood of 1 million cu. yd., covering an area of some 40 acres. Normally, the wet fly-ash is extracted from the lagoons by grab, dumped on the banks to dry and later loaded by the grab into tipper vehicles for removal. Recently, however, the Fly-Ash Division of **Stephenson Clarke Limited,** Ipswich, has embarked on the task of shifting the ash in wet slurry form, using waterproofed "U"-shaped light-alloy tippers. Five of these vehicles —standard Bonallack models except for the waterproofing—are now shifting over 700-cu. yd. of wet slurry a day, to a point some two miles distant from the lagoons. This is believed to be the first time that the slurry, having a water content of approximately 40 per cent., has been moved in "wet" condition.

OVERSEAS Steam Engineering Practice

Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment

Steam generators of 1.432 million lb./hr. for 200-MW unit

In Silesia, a new large power plant installation is under construction, the final capacity of which will amount to 1,200-MW. In the first stage, four units each of 200-MW capacity will be installed. This plant will be located in the vicinity of recently opened-up brown-coal fields, and it will constitute the largest central power station in Poland. Steam turbines and alternators will be supplied from Soviet Russia, while the design and construction of the six steam generators will be carried out by the K.S.G. Co. Stuttgart. The fuel is a brown-coal of 45 to 50 per cent. moisture content, 20 to 25 per cent. ash, and 45 per cent. volatile constituents, the lower heating value being approximately 1,800 k/cal per kg. The boiler furnaces are of irregular eight-sided cross-section, with tangential eight-corner firing. The cross-section of the furnace has an area of 175 sq. m. (1,883 sq. ft.) and a volume of 4,800 cu. m. (169,488 cu. ft.). The steam generators are of the natural circulation type, operating at 152 atm. g. (2,158 lb./sq. in.) and 540 deg. C. (1,005 deg. F.) live steam temperature, and 540 deg. C. (1,005 deg. F.) reheat steam temperature. Feedwater at 240 deg. C. (464 deg. F.) enters the economiser " h " (see outline arrangement, Fig. 1), consisting of six tube groups, in which it is heated to 333 deg. C. (532 deg. F.). The evaporative section " a " consists of vertical tubes of only 51 mm. (2 in.) dia. In order to ensure stable operating conditions, the boiler unit consists of two separate systems with separate circuits after the feedwater admission valve. The saturated steam passes into the radiant superheater " d " lining the furnace throat, and subsequently into a convection superheater " g " where the steam is heated to 485 deg. C. (905 deg. F.). It then passes through a heat-exchanger which forms the first reheat stage of the partially-expanded steam returning from the h.p. turbine for reheating. The high-pressure steam is then brought to final temperature of 540 deg. C. (1,005 deg. F.) in a panel-type superheater " e." In order to safeguard steam temperature control, water injection controls are placed before the convection-type superheater and before the first panel superheater section and before the last panel superheater section. The second reheater stage is a section " f " placed between the live steam panel type superheater and the live steam convection superheater. Combustion air is preheated to 270 deg. C. (518 deg. F.) in three Ljungström preheaters operating in parallel. (*Th. Geissler, BWK*, Vol 11, October, 1959, pp. 463-465.)

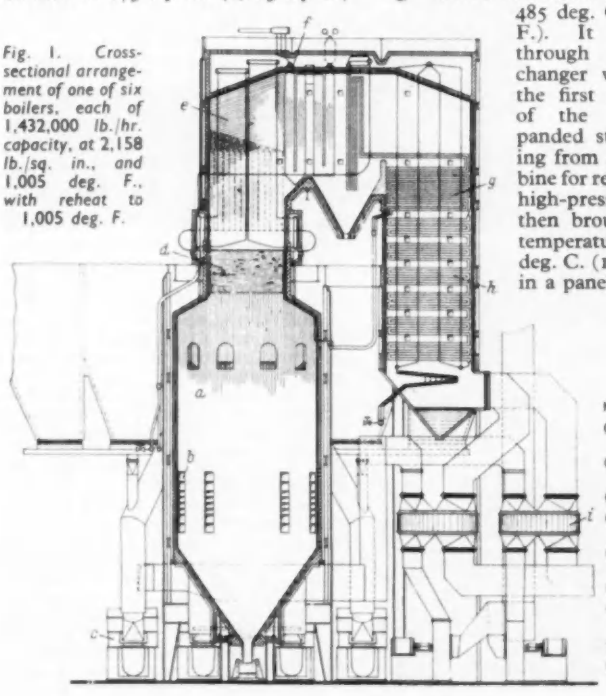


Fig. 1. Cross-sectional arrangement of one of six boilers, each of 1,432,000 lb./hr. capacity, at 2,158 lb./sq. in., and 1,005 deg. F., with reheat to 1,005 deg. F.

Fly-ash disposal

The plant installed at the Sewaren station of the Public Service & Gas Co. of America comprises four boilers, supplying steam at 1,500 lb./sq. in. and 1,050 deg. F. to four turbo-alternators with a total output of 470-MW. The boilers are p.f.-fired units, each burning 950-tons/day of coal. Fly-ash is collected by a fully-automatic, pneumatically-operated system and sold as an additive to concrete. During 1957 some 4,100-tons was disposed of for this purpose. Combustion gases from the four boilers pass through four large-capacity combination electrical-mechanical precipitators, where fly-ash particles are removed. Ten collecting hoppers under each precipitator on units 1, 2, and 3, and fifteen under the precipitator of unit 4 retain the trapped out residue. After the hoppers have collected fly-ash over an 8-hr. period, the handling system is automatically placed in operation. At the base of each hopper a motorised rotary feeder brings the contents of the hoppers into a bulk flow conveyor. A small amount of fly-ash is collected in the economiser hoppers and fed by a screw-conveyor to the bulk flow conveyor. The latter conveyor carries the fly-ash to the receiving hopper of a fluidising pump for transfer through a conveying pipeline to either an ash rejection tank or the storage silo. The conveying operation takes about 2-hr. after hoppers on the next boiler unit begin unloading. This staged system of operation has two advantages; only one main conveying pipeline handles all four pumps;

and, one rotary compressor supplies all the air for pump operation. The screw-type pump and conveying pipeline operate on the principle that air tends to fluidise fine, dry solids, minimising friction, making particles suitable for pumping. Fly-ash drops by gravity into a receiving hopper of the pump and is advanced through the pump barrel by the impeller screw. As it advances, it is compacted to prevent blowback. This is done by the decreasing pitch of the impeller screw and a variable space between the last screw flight and a check valve. Passing the check valve, the fly-ash enters the pump's mixing chamber where compressed air from a series of jets transfer it to a fluid state. Entering the conveying pipeline, it is moved as a dense column at a low velocity. Handling has been made especially flexible through a two-way valve which permits unsuitable ash to be pumped directly to an ash reject tank. Diversion is manually-controlled. High- and low-level indicators in the pump receiving hopper control the conveyors under the precipitator hoppers. Fly-ash for sale is stored in two silos with a total capacity of 380 tons. (*Electrical World*, June 8th, 1959.)

New British Standard

This new publication for B.S. 3082: 1959, forms Part 2 in a series of British Standards which will deal with the mechanical testing of steel at elevated temperatures. It is based on the work undertaken by Technical Committee 17 (Steel) of the International Organisation for Standardisation and has been tentatively approved by all the member countries represented by that committee. It is hoped that the series will help to facilitate the comparison of different steels at elevated temperatures, and to unify the methods by which the data are obtained. In this part, definitions for gauge length, stress and proof stress are followed by requirements for the test-piece. Consideration is given to the limits within which the heating apparatus must operate, and to the method for measuring the temperature. Other requirements deal with: the accuracy of the testing machine; temperature and stress rupture readings; and with the presentation of results. Copies of this British Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 4s. (Postage will be charged extra to non-subscribers.)

* * *

Lafarge Aluminous Cement Co. Ltd., 73, Brook Street, London, W.1, the well-known manufacturers of Ciment Fondu, aluminous cement, have been appointed main distributors of the first British-made Super Sulphated Cement. This cement is made by Frodingham Cement Company, Scunthorpe, from a granulated slag of unusually consistent composition, from the works of Appleby Frodingham Steel Co. (a branch of United Steel Companies Limited), and it is claimed that this slag gives a cement of extremely dependable quality and performance. Frodingham Super Sulphated Cement will, it is claimed, harden at approximately the same rate as Portland cement, and it has a very high resistance to sulphates, sea-water, oils, fats and dilute acids. The very low heat of hydration makes it particularly suitable for mass concrete work even under hot or tropical conditions.

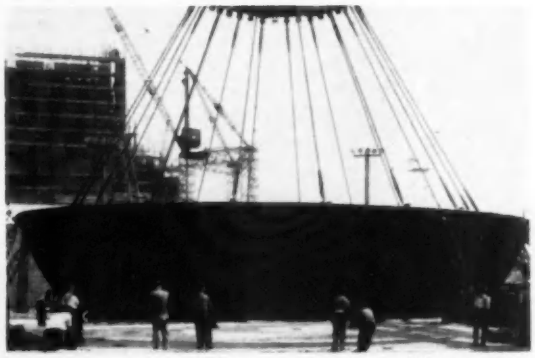
* * *

The Mitchell Construction Co. Ltd., Peterborough, has been awarded a contract by the Central Electricity Generating Board for the construction of a reinforced-concrete, brick-lined, chimney at Uskmouth "B" generating station, Newport, Mon. The chimney, which will be mounted on a 66-ft. plinth, will be 334-ft. in height, making a total height from ground level of 400-ft.

Plessey Nucleonics Limited, Northampton, are to supply burst-slug detection equipment to the Central Electricity Generating Board, for the nuclear power station now being constructed at Trawsfynydd in North Wales. The fuel elements in the core of this reactor will be canned in metal sheaths. If a sheath should burst, active fission products would be released and, if allowed to enter the reactor coolant unchecked, contamination would occur. The Plessey Nucleonics installation will detect a burst and locate the affected element so that it can be removed before there is a serious build-up of activity. It will consistently maintain the required level of sensitivity, and yet be compact and comparatively inexpensive. The equipment is similar to that designed by Plessey Nucleonics Limited for most of the nuclear power stations in Britain, and for the Latina power station in Italy.

Following on the recent success in providing boilers for the nitrogen factory of Fisons Limited, at Stanford-le-Hope, Essex, **G.W.B. Furnaces Limtited** Dudley, Worcestershire, announce that they are to supply what is probably the largest packaged boiler plant to be installed in Great Britain. The contract is in connection with the modernisation and concentration plans of Henry Wiggin & Co. Ltd., at their new factory at Hereford. Consulting engineers for the contract are W. C. Atkins & Partners, London. The installation will consist of five "Model 600" Powermaster packaged automatic oil-fired boilers, capable of producing from 4,000-104,000-lb. /hr. at efficiencies of over 80 per cent. Using 3,500 sec. Redwood No. 1 oil or C.T.F. 200, the Powermasters will be used to provide space and process heating. Installation of the boilers will commence early next year.

PROGRESS AT HINKLEY POINT NUCLEAR POWER STATION



When completed, the Hinkley Point nuclear power station, being constructed for the C.E.G.B. by the English Electric-Babcock & Wilcox-Taylor Woodrow Atomic Power Group, will comprise two natural uranium, gas-cooled, graphite-moderated reactors, each with six associated steam-raising units, the latter supplying steam to six 93.5-MW capacity main turbo-alternators. The accompanying illustrations show (left) the 400-ton capacity Goliath crane, which was supplied by Babcock & Wilcox, lifting the first section of the 67-ft. dia. spherical pressure vessel prior to placing it within the completed shell of No. 1 reactor. The pressure vessel is fabricated from 3-in. thick steel plates, shaped and welded together to form "courses." These are then lifted separately into the reactor shell and there welded together to form the sphere. The illustration (above) shows the preparations for lifting the second "course" into position.

Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Oil-fired boiler

This invention relates to boilers of the multitubular-type with a smoke-box at the front end, within which is located an oil burner; the combustion-air being supplied to a combustion space around the burner by means of a fan. According to the invention there is an outer air duct adjacent to the inner or outer periphery of the smoke-box. At one side of the smoke-box there is an inlet through which combustion-air is delivered from the fan to the outer air duct, and there is an inner air duct connected to the outer air duct from which combustion air is delivered tangentially to the combustion space. Figs. 1 and 2 show the invention as applied to a "packaged" boiler which has at its front end a cylindrical smoke-box (3). The cylindrical sleeve (5) is concentrically mounted against the front wall (4), forming a combustion space (6) containing the oil burner (6a). The delivery side of an induced-draught fan, not shown, is connected to an inlet (9). The inlet (9) opens into an outer annular air duct (10) which may be mounted on the external periphery of the smoke-box (3). Preferably, however, the duct (10) is within the smoke-box, and the peripheral wall of the smoke-box forms the outer wall of the duct. The side walls of the duct are formed respectively by the front end wall (4) of the smoke-box and an annular flanged plate (11) carrying the sleeve (5). The inner wall of the outer air duct (10) is formed by the partition (12), of substantially annular shape, which is flattened at its upper side so as to form an enlarged air space (10a) at the top of the duct. Also in the inlet (9) are mounted baffles (13) for dividing the incoming air equally between the two halves of the air duct (10) as it passes upwards to the enlarged air space (10a). Air from the air space (10a) is passed downwardly through apertures in the flattened portion of the partition (12) and in the sleeve (5) respectively, into an inner annular air duct (14), from which it is discharged tangentially into the combustion space (6). The inner wall of this inner air duct is formed by a cylindrical and flanged sleeve (15) which is slit longitudinally and has one longitudinal edge shaped to engage the sleeve (5) which forms the outer wall of the duct. Between the longitudinal edges of the sleeve (15) is formed a tangential inlet, the effective area of which is controlled by a pivotal flap valve (16). The rear of the sleeve (15) has a flange extending towards the sleeve (5), the latter being lined with a refractory material (17) in the area of the combustion space immediately behind the sleeve (15). A flange at the front end of the sleeve (15) is connected to the front wall (4) of the smoke-box. In this front flange one or more ports (18) are formed, through which combustion air can pass from the inner duct (14) to an air-chest (19) on the outside of the front end wall of the boiler, and on which the burner (6a) is mounted. Around the air-chest the front end wall of the smoke-box has a number of apertures through which cleaning rods can be introduced into the tubes (7 and 8) of the boiler, these apertures normally being closed by detachable cover plates (20). *British Patent No. 815,909 issued to The Cradley Boiler Co. Ltd. Complete specification published July 1st, 1959.*

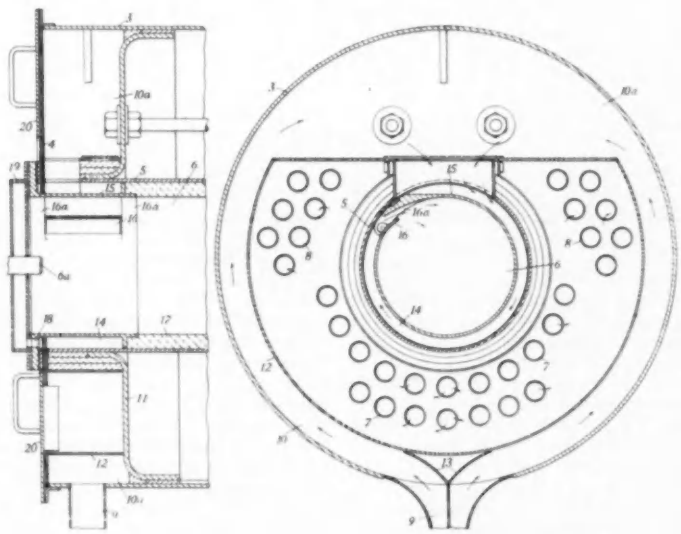
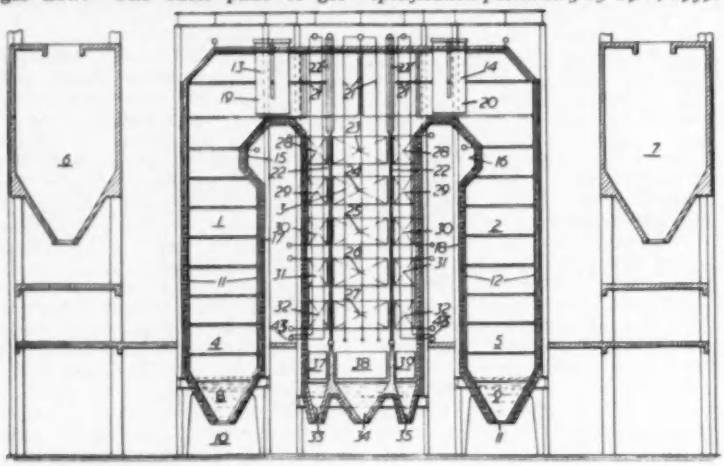


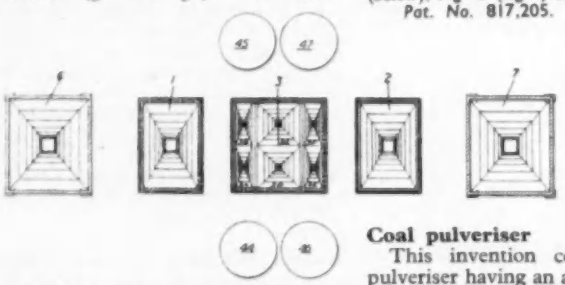
Fig. 1 (left), Fig. 2 (right) British Patent No. 815,909.

Steam generator with two radiation chambers

This patent relates to water-tube boilers of the type which includes two upright radiation chambers, designed to operate with the gases flowing upwards through these chambers. In Figs. 3, 4 and 5 the upright radiation chambers (1 and 2) are placed on opposite sides of a common gas downpass (3); the chambers (1 and 2) being provided with lower combustion zones (4 and 5). The radiation chambers have hopper-bottoms (8 and 9) with outlets (10 and 11) for the removal of ash. The common gas downpass (3) communicates at its upper end with the radiation chambers through transverse gas passes (13 and 14). These gas passes contain radiant superheater sections, including pendent platens such as (19 and 20). The common gas downpass (3) is divided into six parallel gas passes (3*A*, 3*B*, 3*C*, 3*D*, 3*E* and 3*F*) as shown in Fig. 4, by steam wall tubes, such as upright

tubes (22). In the central pair of gas passes are placed reheater sections (23, 24 and 25) followed by economiser sections (26 and 27) arranged in series with respect to gas flow. The outer pairs of gas passes contain the primary superheater sections (28, 29 and 30). These are followed by economiser sections (31 and 32). The heat-exchanger sections are suitably suspended from upright tubes such as (21), which at their lower ends are bent sideways to connect with inlet headers (43 and 43¹). The walls dividing the common gas pass into parallel paths terminate above the outlet openings (37, 38, 39 and 40), and at the upper end of the common gas pass (3) between the gas passes (13 and 14). The dividing walls formed by tubes (22) are arranged to allow the flue gases to flow from the passes (13 and 14) into all the parallel passes. The outlet openings (37, 38, 39 and 40) are connected by ducts (41 and 42) to air-heaters (44 and 45) at opposite sides of the common downpass (3). There may be more than one air-heater at each side of the downpass, as is shown in Fig. 4, where four air-heaters (44, 45, 46 and 47) are arranged, two on each side of the downpass. Dampers such as (48 and 49) are provided in the ducts leading from the outlets in order to control the distribution of hot gases between parallel gas passes (3*A*, 3*B*, 3*C*, 3*D*, 3*E* and 3*F*). *British Patent No.* 817,205 *issued to Babcock & Wilcox Limited. Complete specification published July 29th,* 1959.





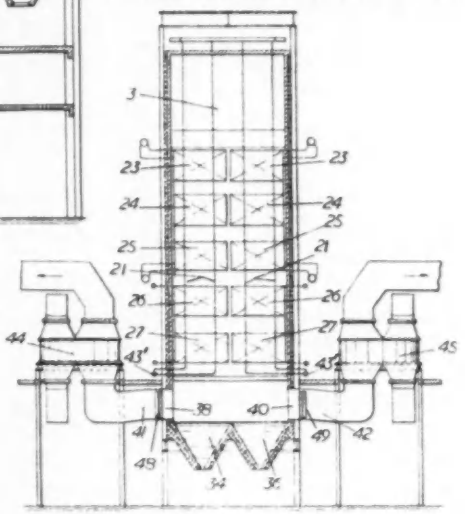
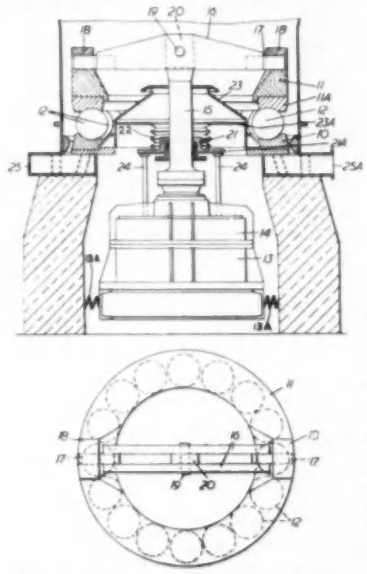


Fig. 3 (above), Fig. 4 (below), Fig. 5 (right) Brit. Pat. No. 817,205.

Coal pulveriser

This invention concerns a coal pulveriser having an annular grinding zone in which grinding elements roll on a stationary grinding-ring or table. Referring to Figs. 6 and 7, it can be seen that the arrangement for grinding comprises a lower, stationary grinding-ring (10) an upper, rotatable grinding-ring (11), and grinding-elements in the form of balls which roll between the two rings. The rotatable ring (11), which is formed with a replaceable ball-engaging ring portion (11*A*), is driven by an electric motor (13) through gearing (14), a central drive-shaft (15) and a cross-piece (16). The motor and gearing have resilient connections (13*A*) to the sides of the pulveriser base. The cross-piece (16) forms part of a cardan or universal coupling, between the motor and the ring (11), and comprises a pair of beams extending diametrically across the ring, at each end of which an axial journal (17) is fixed, i.e., welded between the beams. The journals are mounted in bearings (18) fixed to, or integral with, the ring (11). A central transverse spindle (19) extends horizontally between the cross-piece beams, and the shaft (15) is formed with a spatulate upper end (20) which is formed with a bearing aperture to receive the spindle (19). Thus, the motor and transmission are suspended from the upper grinding ring (11), the journals (17) allowing for movement on the horizontal axis of the cross-piece (16) and the spindle (19) allowing for movement on a horizontal axis transverse to the cross-piece axis. A stuffing-box (21) surrounded by a flexible metal sleeve (22) is provided on shaft (15) to prevent passage of pulverised material, or gas to the motor and gearing. The sleeve (22) extends between flange (21*A*) of the stuffing-box, and flange (23*A*) of a distributor plate (23). The upper part of the box (21) is supported on the casing of the motor and gearing by stay rods (24) attached to the flange (21*A*). The distributor-plate (23) is provided to guide material to be pulverised into the grinding-zone. An annular windbox (25) with an inlet conduit (25*A*) is provided around the grinding-zone to supply an upward stream of high-pressure air, to convey pulverised material from the grinding zone. In operation, material to be pulverised is fed from above, through a central feed conduit (not shown) to the grinding-zone, the plate (23) distributing the fuel evenly around the zone where pulverisation is effected. In the pulveriser shown, the grinding pressure is obtained from the weight of the suspended driving means with possibly an associated counter-weight. Pulver-

ised-fuel is picked up from the outer rim of ring (10) by streaming upwards from the windbox (25), and is thus conveyed from the grinding zone. As the upper grinding ring (11) rotates it is necessarily subject to additional oscillatory and vibratory movements. Due to the driving means being suspended through a cardan-coupling from the rotating-ring a large proportion of these additional movements are not transmitted to the shaft, or the driving motor and gearing. Also, as the shaft is not subjected to bending stresses, and maintains a steady and substantially vertical position, a sealing gland, such as stuffing-box (21), can be provided without difficulty. *British Patent No.* 821,919 *issued to Babcock & Wilcox Limited. Complete specification published October* 14*th*, 1959.



Figs. 6 and 7. British Patent No. 821,919.

Seal for rotary regenerative heat-exchanger

This patent envisages an improved rotary regenerative heat-exchanger for the transfer of heat between waste gases and compressed air in a gas turbine cycle. Figs 8 and 9 show diagrammatically a cylindrical shell (10) of a rotor peripherally supported at (11) and rotated about its axis by a motor and reduction gearing (13). The rotor carries a mass of regenerative heat-transfer elements (14) which first absorb heat from the hot gases entering the heat-exchanger through a duct (15) from a combustor or other heat source. After traversing the flow passageways (19) in the element (14) the cooled gases are discharged through an outlet duct (16). As the rotor is turned about its axis, the heated element is moved into a stream of relatively cool compressed air supplied through a duct (17). After flowing over the heat transfer material (14), and absorbing heat from it, the stream of heated air is conveyed outward through the outlet duct (18) to the point of use. It will be noted that ducts (15, 16 and 17, 18) are each positioned eccentrically to the rotor axis. In order that streams of gas or air may not bypass the heat transfer material carried by the rotor by flowing through the annular clearance space between the rotor and the enclosing structure (24), additional seals in the form of circumferential members (26) are provided around the periphery of the rotor. The seals (26) may be of any conventional type which permits extensive distortion of the rotor. The sealing members (22*A* and 22*B*) are similarly shaped annular members, with one or more annular grooves (27) (Fig. 10) in each face (28) adjacent to the rotor-sealing-surfaces (20*A* and 20*B*). The opposite side (32) of each annular member is attached to an extending duct (34), which may be arranged to hold each sealing member against, or at a fixed distance from, its adjacent rotor surface. The other end of each duct (34) is in turn connected to the inlet duct provided for a high-pressure fluid on one side, and to the outlet duct for this fluid on the opposite side. The sealing means (22*A* and 22*B*), in co-operation with the adjacent sealing surfaces of the rotor, preclude the passing of excessive fluid into the low-pressure gas ducts (15 and 16). They simultaneously serve as fluid-flow passageways which permit the equalisation of fluid pressure between the sealing means. The annular sealing members (22*A* and 22*B*) are provided with one or more annular grooves (27) which serve as passageways to permit the free flow of fluid around these sealing members. By this arrangement high-pressure fluid trapped in the matrix passageways (19), positional between the annular sealing members (22*A* and 22*B*), but which passageways have moved beyond the high-pressure duct (17, 18) in the direction of rotor rotation, can flow through the annular grooves (27) and around to the matrix passageways (19). By this means, the carry-over of high-pressure fluid entrapped in the rotor is minimised. *British Patent No.* 821,993 *issued to The Air Preheater Corporation. Complete specification published October* 14*th*, 1959.

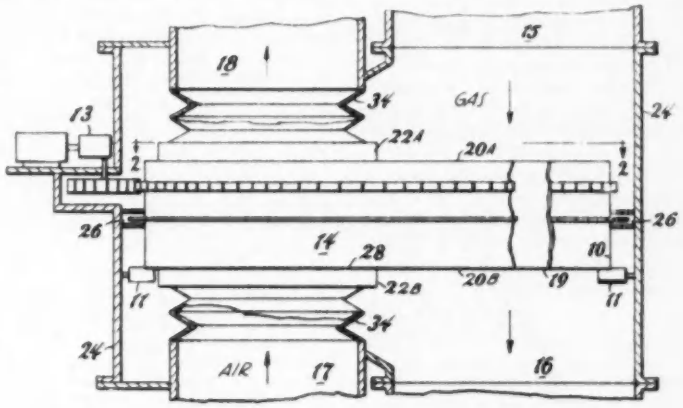


Fig. 8. British Patent No. 821,993.

Fig. 10. British Patent No. 821,993.

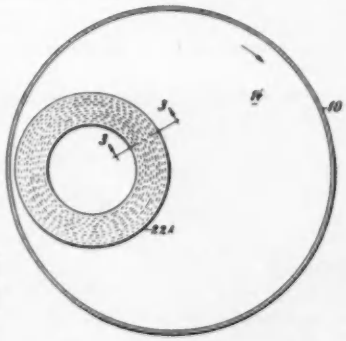


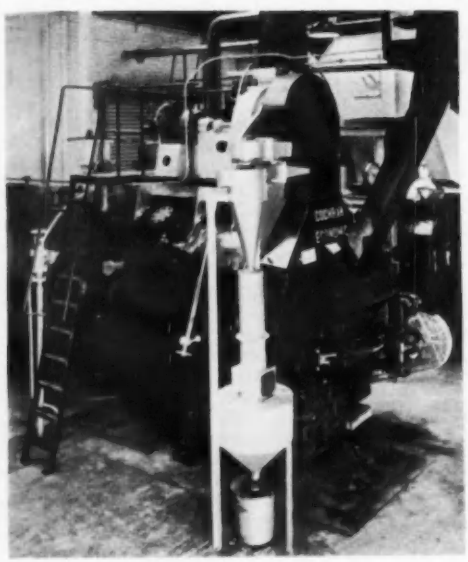
Fig. 9. British Patent No. 821,993.

Light-sensitive devices

It will be appreciated that both the efficiency and the accuracy of any form of smoke-density measuring apparatus which is designed to incorporate the use of some form of photo-cell, largely depends upon the stability of the light output from the light source, and this output is very sensitive to mains voltage fluctuations. Further, certain photo-electric cells—for example, emission type cells—are also voltage sensitive, and any amplifier used in the circuit of such measuring apparatus may also be voltage sensitive. It is an object of this invention to provide apparatus whereby errors caused by voltage fluctuations are substantially eliminated. A typical example is that in which a photo-electric cell of the selenium-barrier-layer-type, which is photo-conductive and photogenerative, is connected in series with a resistor and an indicating instrument such as a micro-ammeter. This cell is acted upon by a light beam from a tungsten filament lamp. The resistor in the circuit containing the photo-electric cell and indicating instrument, is common to a second circuit in which current from the same source of supply as that which operates the tungsten filament lamp is caused to flow through the resistor and hence a voltage is applied to the photo-electric cell in the direction opposing that of the electromotive force generated by the cell as a result of the action on it of the illuminating beam. This second circuit incorporates a rectifier, and is supplied from the secondary winding of a transformer or from a "Variac." A resistor having non-linear characteristics may be inserted into the second circuit, which would cause the injected voltage to be subject to a much higher percentage variation on adjustment of the slider. In this way compensation is obtained from an injected voltage of low mean value and subsequently the sensitivity of the cell is not depreciated to any considerable degree. However, as it is necessary to have a rectifier in the circuit, it is preferred to use the non-linear characteristic of the same rectifier when operated below its rated voltage. The non-linear part of a rectifier's characteristic is inclined to be temperature sensitive, and it may be necessary to provide compensation, such as a temperature-sensitive resistor which may be a thermistor or a nickel bobbin. *British Patent No.* 815,988 *issued to Kelvin & Hughes Limited. Complete specification published July* 8*th*, 1959.

Flexibox Limited, Trafford Park, Manchester 17, have issued a new comprehensive mechanical-seal catalogue in which is described the full range of Flexibox balanced and unbalanced mechanical gland seals for all types of rotary shaft equipment-pumps, mixers, agitators, compressors, etc. This catalogue has been primarily designed to provide mechanical seal users with a rapid means of selecting the correct type and size of seal for any given application. To this end tables of essential dimensions, operating limits, power absorption and frictional heat development nomograms and details of PV ratings have been included. In addition, a recommended materials specification for seal components is given for more than 350 fluids. Copies of the new catalogue are obtainable from the Public Relations department of the Company at Manchester.

Sturtevant Engineering Co. Ltd. featured numerous interesting exhibits at the recently-held Clean Air Exhibition in London. In addition to the standard range of electrostatic precipitators and associated equipment for large power station and industrial installations—for which this firm is widely known—they also supply filters and filtering equipment for air-conditioning plant, and collectors for the mechanical collection of grit and dust. Sturtevant electrostatic precipitators for cleaning gases from power stations, metallurgical works, chemical works, cement works, etc., are in successful operation in many parts of the world; models of such precipitators were shown at the exhibition. Sturtevant industrial vacuum cleaners are extensively used for flue and boiler cleaning in stoker-fired, p.f.-fired and oil-fired boiler plants. The Sturtevant multi-cyclone type "Newgate" mechanical collector was also featured by means of a scale model. The "Newgate" collector is designed to arrest the comparatively coarse grits emitted by small and medium-sized boilers. It is a combined induced-draught fan and grit-collector, and can be used with either hand-fired or stoker-fired boilers. Of advanced and compact design, it requires the minimum amount of space, and is made in a range of sizes to deal with boiler capacities from 2,000 to 20,000 lb. hr. of steam. It is readily adaptable to all types of shell boilers, and is claimed to have a consistently high collection efficiency. Furthermore, it can be used as a pre-collector ahead of an electro-static precipitator.



The Sturtevant "Newgate" collector fitted to a Cochran Economic-type boiler.

Five British engineering companies announced on October 20th that they have joined together in a new consortium known as **Power Construction Limited,** to design and construct "packaged" power stations in any part of the world. The companies are: Armfield Hydraulic Engineering Co. Ltd., Belliss & Morcom Limited, Cory Brothers & Co. Ltd. (a member of the Powell Duffryn Group), Lancashire Dynamo Holdings Limited, and the Mitchell Engineering Group Limited. It is stated that the consortium will take advantage of the modern trend of small power stations being ordered as a unit rather than separate contracts being given for different aspects of the job.

* * *

Work is to commence on the construction of the foundations and superstructure housing the coal, ash and dust-handling plant at Uskmouth "B" Power Station, near Newport, Monmouthshire. The contract has been awarded by the Central Electricity Generating Board, Midland Project Group, to **M. J. Gleeson (Contractors) Limited,** North Cheam, Surrey, and is valued at £250,000. The scheme is to be completed by October, 1960; the consultant engineers being L. G. Mouchel and Partners, London.

* * *

Humphreys and Glasgow Limited announce that their agreement with Alco Products Inc., New York, in connection with nuclear power station units of up to 30-MW capacity has been terminated by mutual consent. Humphreys and Glasgow are now prepared to offer a similar range of comprehensive power stations incorporating pressurised-water reactors designed and manufactured by Babcock & Wilcox Limited, London.

* * *

Radiovisor Parent Limited, Stanhope Works, High Path, London, S.19, have recently issued a new leaflet entitled "Photo-electric and Electronic Controls." This illustrates and describes over twelve items of the company's standard equipment.

Edwin Danks of Oldbury announce a reduction of 7½% from the standard List prices of Oldbury Chain Grate Stokers

ordered in the twelve months commencing 1st November 1959.

Hire purchase terms are available from that date.

This offer is made in recognition of the national importance of maintaining a healthy coal industry and in support of the National Coal Board Campaign.

Proved by 17 years' successful operation, the Oldbury Stoker endorses the claim of the National Coal Board that coal, the home produced fuel, is competitive in price and performance with other fuels.

The Oldbury Stoker, the first successful chain grate stoker for shell boilers, was developed by Edwin Danks of Oldbury in 1942 with the prime object of burning efficiently low grade slacks, owing to the shortage of graded fuels. To-day, more than 6,000 Oldbury Stokers are in the service of industry, burning all sorts of solid fuel.

ECONOMICALLY
by reducing fuel and labour costs.

SMOKELESSLY
in compliance with the Clean Air Act.

Manufacturers who appreciate the manifold advantages of burning Britain's native coal are invited to send for details of our Special Offer and Publication 1618 THE OLDBURY STOKER.

EDWIN DANKS & CO., (OLDBURY) LTD.

OLDBURY BIRMINGHAM. Telephone: Brierley Hill 77311

LONDON · BIRMINGHAM · CARDIFF · GLASGOW · LEEDS
MANCHESTER · NEWCASTLE-ON-TYNE.

NOTES Personal AND Industrial

Mr. Airey Neave, M.P. for Abingdon, Berks., has been appointed to the main board of directors of John Thompson Limited, Wolverhampton. He will direct the London affairs of the John Thompson group. From January, 1959, until the last Parliament was prorogued, Mr. Neave was Under Secretary of State for Air, and had earlier held Parliamentary Secretaryships to the Minister of Transport (1957-1959) and the Colonial Secretary (1954-1956).

* * *

Mather and Platt Limited announce that **Mr. William Loris Mather** will become chairman of the board of directors, in succession to his father, **Mr. L. E. Mather,** who will retire from the chairmanship and also from the board on March 31st, 1960.

* * *

At the annual general meeting of the British Standards Institution, held in London recently, **Mr. R. E. Huffam** was re-elected for a second term of office as the Institution's president. Mr. Huffam was, until his recent retirement, United Kingdom Co-ordinating Director of Unilever Limited. The three deputy-presidents of the Institution were also re-elected. They are: **Sir Roger Duncalfe, Sir Herbert Manzoni** (city engineer of Birmingham), and **Mr. John Ryan** (vice-chairman, Metal Box Co. Ltd.).

* * *

Mr. J. E. Smith, a director of Richardsons Westgarth & Co. Ltd., Wallsend-on-Tyne, and managing director of their subsidiary, The North Eastern Marine Engineering Company, is resigning from these appointments at the end of this year, to become managing director of the National Gas & Oil Engine Co. Ltd. He will also become a member of the board of Hawker Siddeley Industries Limited.

* * *

Mr. Andrew Laird has relinquished his post as technical officer with the Combustion Engineering Association, to take up another appointment. **Mr. T. G. Edmondson** has been appointed to succeed Mr. Laird. After a period of training with Humber Limited, Mr. Edmondson served with J. & E. Hall Limited, and later with Todd Oil Burners Limited.

* * *

Dr. T. Bedford, who has retired from his appointment as director of The Medical Research Council's Environmental Hygiene Research Unit, has been appointed as consultant on heating, ventilating and air-conditioning by Teddington Industrial Equipment Limited.

* * *

Mr. Michael J. S. Clapham has been appointed chairman of I.C.I. Metals Division from January 1st, 1960, in succession to **Dr. Maurice Cook,** C.B.E., who will retire from the company's service on December 31st, 1959.

Mr. E. S. Booth, M.Eng., M.I.Mech.E., M.I.E.E., has been appointed a full-time member of the Central Electricity Generating Board. Mr. Booth has been chief design and construction engineer of the C.E.G.B. since December, 1957. He was educated at Batley Grammar School and Liverpool University, where he graduated with a first-class honours degree in engineering. He received his initial training with the Metropolitan-Vickers Electrical Co. Ltd., became a construction engineer with the Yorkshire Electric Power Company, and was subsequently city electrical engineer and manager at Salford. Upon nationalisation of the electricity supply industry in 1948, Mr. Booth served with the British (later the Central) Electricity Authority as generation construction engineer, North Western Division, and afterwards successively as generating station construction engineer, and deputy chief engineer (design and construction) at headquarters.

* * *

Mr. D. G. Gwyn, B.Sc., A.M.I.E.E., has been appointed a member of the South Wales Electricity Board, while continuing to serve as a full-time officer. Mr. Gwyn has been manager of the South Wales Electricity Board's Monmouthshire and Mid-Wales Area since 1958, having previously been manager of the West Wales Area (1953-57).

* * *

Major W. R. Brown has relinquished the post of joint managing director of The Power-Gas Corporation Limited, but continues as chairman of the board. **Mr. C. E. Wrangham** is now sole managing director of the company, and continues as vice-chairman of the board.

* * *

Mr. J. Dummelow, M.A., A.M.I.E.E., has been appointed manager of the Publicity Department of Metropolitan-Vickers Electrical Co. Ltd. Mr. Dummelow was educated at Marlborough and Clare College, Cambridge. After a college apprenticeship, followed by technical publicity work at Metropolitan-Vickers, he joined the Publicity Organisation of the General Electric Co. Ltd. in 1929. During the war he served with the Royal Engineers. Rejoining Metropolitan-Vickers in 1946, he became Editor of the "M-V Gazette," and also Press officer. He has been assistant manager, Publicity Department, since April, 1957.

* * *

Mr. Kenneth Druce, D.F.H., A.M.I.E.E., has been appointed sales manager to The English Electric Company of South Africa (Pty.) Limited, and will join the staff in the Johannesburg office. For the past two years he has been manager of the company's Bristol office responsible for the South-Western area, where he will be succeeded by **Mr. W. M. Todd.**

Mr. K. Chatterton, A.M.Inst.C.E., chief engineer, parent company; **Mr. A. M. Simmers,** A.C.A., secretary and chief accountant, parent company; and **Mr. A. Taylor,** A.C.A., chief accountant, subsidiary companies, have been appointed special directors of the English Steel Corporation Limited.

* * *

Mr. E. W. A. Richards, former assistant secretary, has been appointed secretary of both Keith Blackman Limited, and the Blackman Export Co. Ltd., and **Mr. A. W. Milborrow** has been appointed chief accountant of Keith Blackman Limited.

* * *

Hick, Hargreaves and Co. Ltd. announces that **Mr. John J. Warburton,** sales manager and special director, has retired after forty-eight years' service. He has been succeeded by **Mr. T. Dougall.**

* * *

Mr. D. K. Fraser, M.I.Mech.E., M.I.Mar.E., at present managing director of Petters Limited, Staines, has been appointed to the board of G. A. Harvey & Co. (London) Ltd.

* * *

Mr. J. W. Ashley, B.Sc., chief engineer of Atomic Power Constructions, Ltd. has been elected to the board as technical director. Mr. Ashley heads the team responsible for the design and construction of the 500-MW nuclear power station now being built by the company for the Central Electricity Board at Trawsfynydd in North Wales.

* * *

Mr. H. A. Parrott has been appointed assistant home sales manager, Cable Division, of Siemens Edison Swan Limited. He succeeds **Mr. R. B. Tucker,** who has resigned from the company to take up another appointment.

* * *

Dr. O. P. Hansom has been appointed technical director of Carter Thermal Industries Limited, and will be responsible for all research and development within the group companies, including Midland Heating and Ventilation Co. Ltd. Dr. Hansom was formerly engineering manager of Flexibox Limited.

* * *

Demag A.G., Compressor Division, Duisberg, has signed an agreement with William H. Capper and Co. Ltd., Mayfair House, 8/9, Hertford Street, London, W.1, under which the British firm has been appointed sole representative in the United Kingdom and Northern Ireland for the sale of all the products of the department.

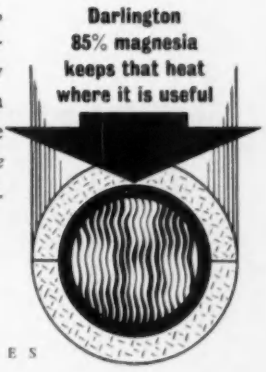
* * *

Elliott Brothers (London) Limited, a member of the Elliott-Automation Group, announces that its branch office in South-West England and South Wales is now at 55, Westgate Chambers, Newport, Mon. (Telephone Newport 65710).

Feathers . . . required avian insulation. Darlington 85% Magnesia—with the feather-like crystal structure of its magnesia constituent—the insulation required for pipes and furnaces, boilers and other places in your plant where precious heat needs to be kept in its place . . . working for you.

Darlington 85% Magnesia, with its very low thermal conductivity, ensures that not more than 10% of your heat escapes. It keeps the air temperature down and the working temperature up, cuts fuel consumption and saves you money.

Besides being a highly effective insulator, Darlington 85% Magnesia has the extra advantages of being very light, clean and chemically inert. It is available for plastic application or in prefabricated pipe sections, slabs or bricks made to standard sizes. *For full details and any advice you need, please write to our Technical Department.*



The Chemical and Insulating Co. Ltd

DARLINGTON, CO. DURHAM

TELEPHONE DARLINGTON 3547

A MEMBER OF THE DARLINGTON GROUP OF COMPANIES

'BOSS' SEAMLESS WELDING FITTINGS
Take advantage of our large stocks of Welding fittings, Valves and Pipe-line Equipment.
WRITE FOR LITERATURE TO :
THE BRITISH STEAM SPECIALTIES LTD.
HEAD OFFICE
FLEET STREET • LEICESTER
TEL: LEICESTER 20685/6/7 • GRAMS: 'BOSS' PHONE LEICESTER
LONDON • LIVERPOOL • GLASGOW • BRISTOL • MANCHESTER
NEWCASTLE-ON-TYNE • BIRMINGHAM • BELFAST AND DUBLIN

MECHANICAL STOKERS—FORCED DRAUGHT FURNACES—CONVEYORS—ELEVATORS

NIAGARA ENGINEERING CO. LTD.

20 BRAZENNOSE STREET,
MANCHESTER 2
DEANSGATE 7930/7939

EARLS COURT,
LONDON, S.W.5
FROBISHER 2111/2

"Half the battle for clean air depends on good equipment, properly maintained. But victory in the battle rests in the hands of the Stoker."

N·I·F·E·S

NEW STOKER'S MANUAL

—more than 10,000 copies already sold

NOW ON SALE

PRICE 2/6d

POST FREE

N·I·F·E·S

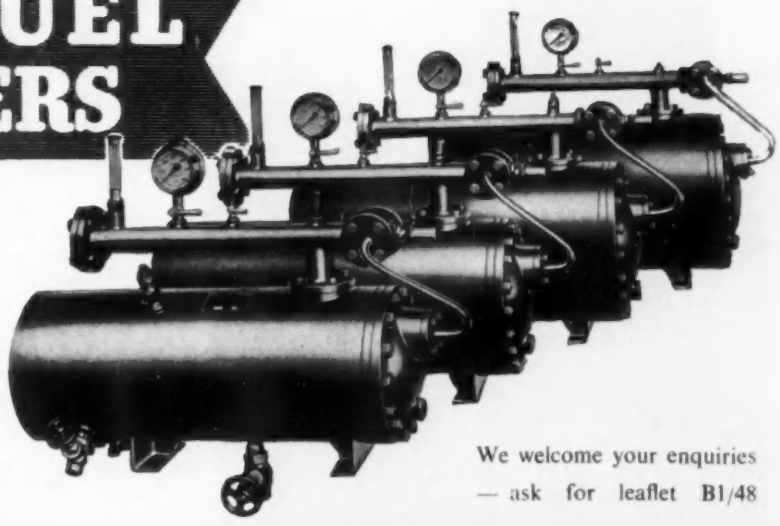
TRAINING COURSE FOR BOILER OPERATORS

—is also available anywhere in the United Kingdom. 2,500 N.I.F.E.S trained men have obtained the City and Guilds Boiler Operator's Certificate.

N·I·F·E·S *National Industrial Fuel Efficiency Service*

71 GROSVENOR STREET LONDON W1 · TELEPHONE: HYDE PARK 9706

OIL FUEL HEATERS

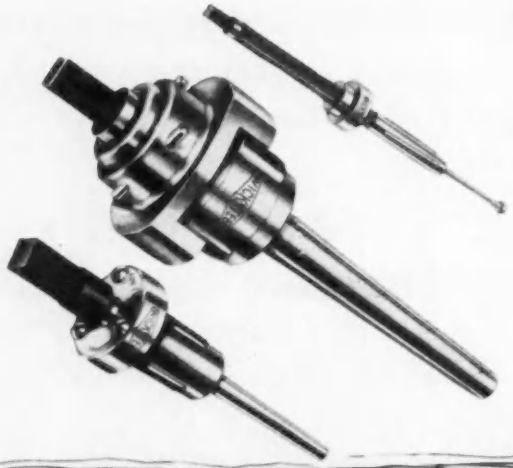


by Caird & Rayner Ltd., for all grades of Fuel Oil and Creosote Pitch. Standard sizes to deal with 10 to 2,000 gallons per hour using Steam or High Pressure Hot Water as heating media.

We welcome your enquiries — ask for leaflet B1/48

Caird & Rayner LTD

777 COMMERCIAL ROAD, LONDON, E.14. TELEPHONE: EAST 3216 (3 lines) TELEGRAMS: VAPORIZE-LONDON

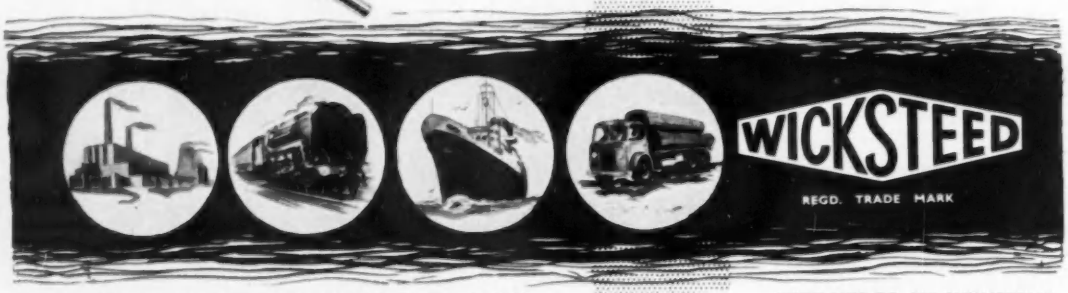


TUBE EXPANDERS

FOR ALL PURPOSES.

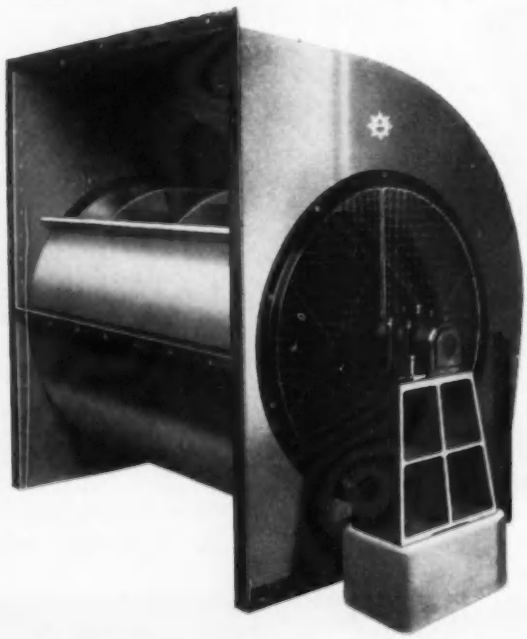
As supplied to the Admiralty, British Electrical Authority, Railways, Oil Refineries, leading Boiler Makers and Industrial users.

LEADING TUBE EXPANDER MANUFACTURERS FOR OVER 70 YEARS



CHARLES WICKSTEED & CO. LTD. KETTERING. Tel. Kettering 3113

SUPPLIERS TO ALL INDUSTRIES



FANS

FORCED AND INDUCED DRAUGHT

EXHAUSTERS

PRIMARY AIR

SECONDARY AIR

RECIRCULATING

FANS FOR ALL OTHER PURPOSES

ALLDAYS & ONIONS LTD.

GREAT WESTERN WORKS, BIRMINGHAM, 11. TELEPHONE: VICtoria 2251-4

LONDON OFFICE: 2, QUEEN ANNE'S GATE, WESTMINSTER, S.W.1. TELEPHONE: WHitehall 1923-4-5

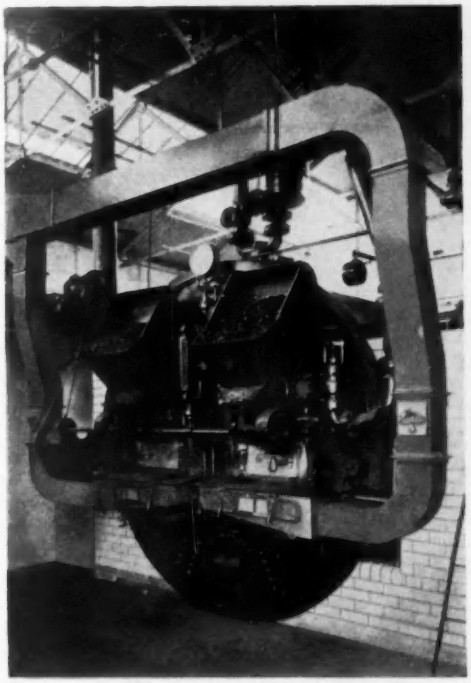
MAINTAIN GREATER OUTPUT . . .

HIGHER EFFICIENCY . . .

MAXIMUM ECONOMY . . .

by installing

TURBINE FURNACES



All enquiries to :

THE TURBINE FURNACE Co. Ltd.,

238b, Gray's Inn Road, London, W.C.1

Telephone: TERminus 4365

Willcox JOINTITE (REGD.)

COMPRESSED ASBESTOS FIBRE JOINTING

puts the BEST in AsBESTos!

For over half a century the Engineers' stand-by for—

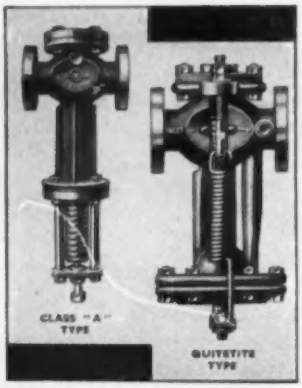
HIGH PRESSURE STEAM, OILS, PETROL, ACIDS, ALKALIS, AMMONIA, etc.

Red or Graphited. Sheets 60" x 48" and thicknesses 1/64, 1/32, 1/16, 3/32 and 1/8 inch. Smaller sizes cut as required. Also ready-cut JOINTS, GASKETS, etc., to customers' drawings or templates. Urgent requirements by return ! Write for quotation and inspection sample.

W. H. WILLCOX & CO. LTD.

Southwark Street, London, S.E.1

HOP 8022—25 lines



TELEPHONE No.: **BRIDGETON 2124**
TELEGRAMS: **"REDUCING" GLASGOW**

Auld's Patent Reducing Valves

FOR ALL DUTIES

ON STEAM, AIR, OR WATER SERVICES

Also Manufacturers of
SURPLUS VALVES, COMBINED SURPLUS AND REDUCING VALVES
FULL BORE RELIEF VALVES, STOP VALVES, DE-SUPERHEATERS
STEAM TRAPS, ETC. FOR ALL PRESSURES AND TEMPERATURES

AULD

DAVID AULD & SONS LTD., WHITEVALE FOUNDRY, GLASGOW, S.E.

Prevent Scale and Corrosion

IN BOILERS, EVAPORATORS, HEAT EXCHANGERS AND PIPELINES WITH

CEPI-COMAV

These new **MAGNETIC UNITS** are fully automatic in operation, requiring no control, maintenance or replenishment.

FOR TREATMENT OF
RAW WATER · SEA WATER · ACIDS · SUGAR & FRUIT JUICES AND MANY COMPLEX INDUSTRIAL FLUIDS.

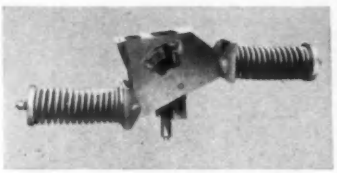
Technical Advice and Literature from Dept. "B"

WILLIAM MATHWIN & SON (NEWCASTLE) LTD

U.K. Representatives and Distributors

190 WEST GEORGE ST., GLASGOW, C.2. | **EXCHANGE BUILDINGS NEWCASTLE-ON-TYNE** | **736 SALISBURY HOUSE LONDON, E.C.2.**

Vokes Genspring Support Hangers in searching corrosion test



Twenty years' service under really severe marine atmospheric conditions has no appreciable effect on the mechanical efficiency of a Vokes Genspring Constant Support Hanger—this was established in a test recently carried out by an independent research laboratory. Using the A.R.E. salt droplet test (BSS. 1391.1952), this ten-week test was designed to represent 20 years of service exposure. Corrosion of the Vokes Genspring Hanger was negligible, even under the severe conditions found near the sea coast, and efficiency checks before and after corrosion tests indicated less than 1% increase in maximum deviation at any position of the travel. Specified for the first three Nuclear Reactor Power Stations (all situated near the sea), Vokes Genspring W3 and W4 Constant Support Hangers have already proved their efficiency. These tests confirm that they will continue to give trouble-free service for many years to come, even in highly corrosive salt-laden atmospheres. Copies of the full test report are available on request.

If you have a pipe suspension problem please write for advice or literature. The two Vokes Genspring catalogues give full details of the different types of Support Hangers, both Constant and Variable.

Vokes Genspring

SUSPENSION SYSTEMS

DEPT. J/6 · VOKES GENSPRING LTD · GUILDFORD · SURREY

VG/21

METERING OF FUEL OIL

The Leeds Displacement Meter Type "P"

The Leeds Displacement Meter is available in sizes ½ inch to 1 inch diameter for the measurement of fuel oils covering the general grades from 35 to 3,500 seconds Redwood No. 1.

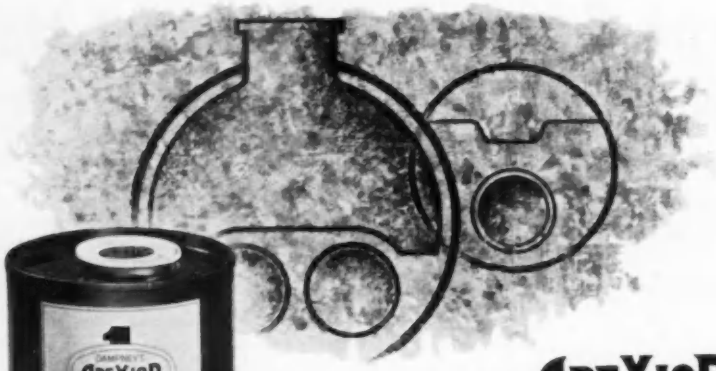
Full details will be forwarded on application to :—

THE LEEDS METER CO. LTD.

TOWER WORKS : ARMLEY : LEEDS 12

Telephones : 63–8034 *Telegrams :* "HELIX, LEEDS 12"

Between you and Boiler Corrosion . . .



An impenetrable shield of APEXIOR REGISTERED No. 1

On guard, and constantly ready to fight against corrosion in boilers or steam raising plant is Apexior No. 1.

Applied as a thin film to surfaces which encounter water or steam temperatures between 170° —1000° F., Apexior No. 1 is an effective, low cost protection for expensive boiler plant. It cuts corrosion to an absolute minimum; reduces scale formation. Any scale which forms can be easily and speedily removed without danger of damage to plant as it is non-adherent.

Other advantages come with Apexior No. 1: heat transmission is improved; and since Apexior is an inert coating, feed water is left completely free from discolouration or contamination. Keep step with industry to-day—be boiler wise and Apexiorise.

For full information on all aspects of Apexior No. 1 write for Booklet "Preventing Boiler Corrosion".

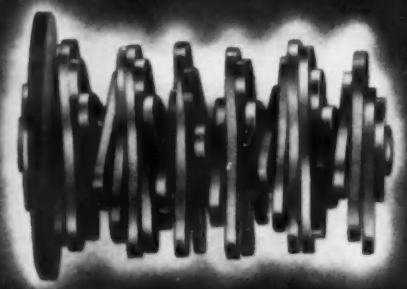
BRITISH PAINTS LIMITED Apexior Division

Portland Road, Newcastle upon Tyne 2

London · Liverpool · Sydney · Adelaide · Durban · Cape Town · Calcutta · Trinidad · New York · Dublin

OUR WORLD-WIDE SERVICE IS AT YOUR DISPOSAL FOR THE ASKING

Now A FLEXIBLE SCRAPER BULLET THE Kez-COIL BULLET

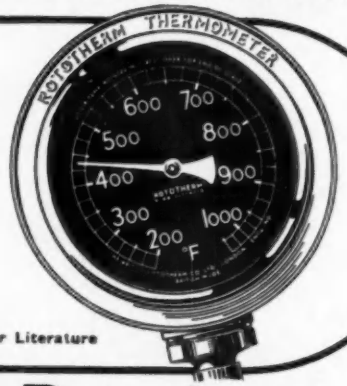


After supplying over 2,000,000 Bullets to various Branches of Industry, we now introduce this remarkable innovation—a new flexible scraper bullet. We will gladly send full details on request.

THE Kleen-e-ze BRUSH CO. LTD.

60, BEVAN LANE, HANHAM, BRISTOL

DIAL THERMOMETERS FOR INDUSTRIAL APPLICATIONS



Write for Literature

Rototherm

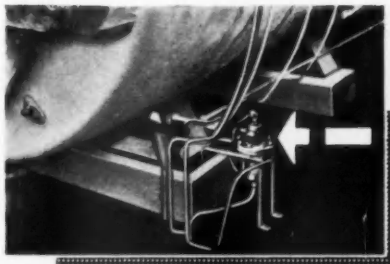
BI-METAL • MERCURY-IN-STEEL • VAPOUR PRESSURE

THERMOMETERS, RECORDERS and CONTROLLERS

THE BRITISH ROTOTHERM CO. LTD.

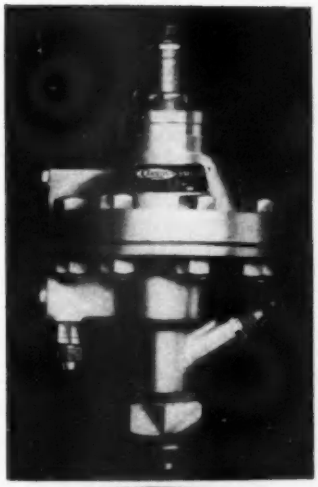
MERTON ABBEY, LONDON, S.W.19. *Telephone*: LIBerty 7661

Branches at NOTTINGHAM, GLASGOW and DUBLIN



THIS IS ALL YOU NEED TO MAKE YOUR BOILER...

Self Clearing



The Carron-Smith Automatic Blow-Down Valve offers you a major advance in boiler maintenance technique. Delays due to the need for regular manual blow-down to maintain boiler efficiency are eliminated, and since the working of the valve is automatic, it requires no attention after installation. The Carron-Smith Automatic Blow-Down Valve has been fitted successfully on boiler plant by Ruston & Hornsby, Thermax, Cochran, Sinuflo, Spencer Bonecourt, Waste Heat and Lancashire, with highly satisfactory results. Write for your copy of the technical leaflet.

CARRON — SMITH

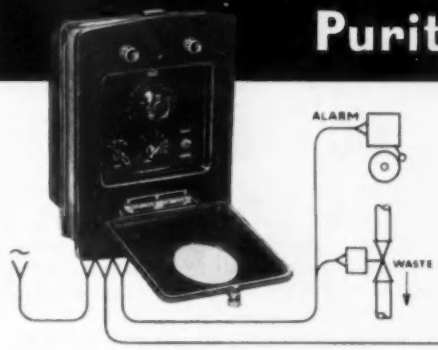
Automatic Blow-Down Valve

100 YEARS OF SERVICE 1859 1959 1759

CARRON COMPANY
ENGINEERING DEPARTMENT
CARRON · FALKIRK · STIRLINGSHIRE

Showrooms and Sub-Offices: 15 Upper Thames Street, London, E.C.4. 22-26 Redcross Street, Liverpool, 1. 125 Buchanan Street, Glasgow, C.1. Sub-Office: 33 Bath Lane, Newcastle upon Tyne.

Ensure Steam Condensate Purity



The RC4 conductivity measuring instrument continuously monitors the purity of return steam condensate; it automatically actuates signals, or control devices, immediately upon the first trace of contamination. This sensitive industrial instrument provides a reliable and economical means of detecting condenser leakage, evaporator priming or boiler carry-over—also available are other electrolytic conductivity instruments for periodic sample testing, and for continuous indication and recording, together with the Electronic Switchgear patented, non-glass conductivity cells with the minimum maintenance characteristic.

Descriptive leaflet available upon request

ELECTRONIC SWITCHGEAR
(LONDON LTD)

LETCHWORTH · HERTS · TEL: 1853

ELECTROLYTIC CONDUCTIVITY MEASURING SETS, RECORDERS, CONTROLLERS AND CELLS · CONTROLS FOR LIQUID AND SOLID LEVELS · TIMING · PHOTO-ELECTRIC PACKAGING REGISTRATION · ETC.

47 VICTORIA ST., WESTMINSTER, S.W.1. ABBEY 2771/5

For fuel burning efficiency

THERE IS

NO

SUBSTITUTE FOR

CO_2 TESTING

The percentage of CO_2 in the flue gases is the only reliable indication of the efficiency of your boiler. In fact, *there is no substitute for CO_2 testing* if you want to maintain maximum efficiency. And it is so simple with the " Fyrite " CO_2 Indicator. With it you can make a test in less than a minute and know immediately whether you are wasting fuel or not. Once you know, you can adjust your boiler for maximum fuel economy. The " Fyrite " is extremely accurate under all conditions and for all types of fuel. A complete kit costs only £17.10.0. Write or 'phone for leaflet.

For convenience and speed

THERE IS

NO SUBSTITUTE FOR THE

"FYRITE"

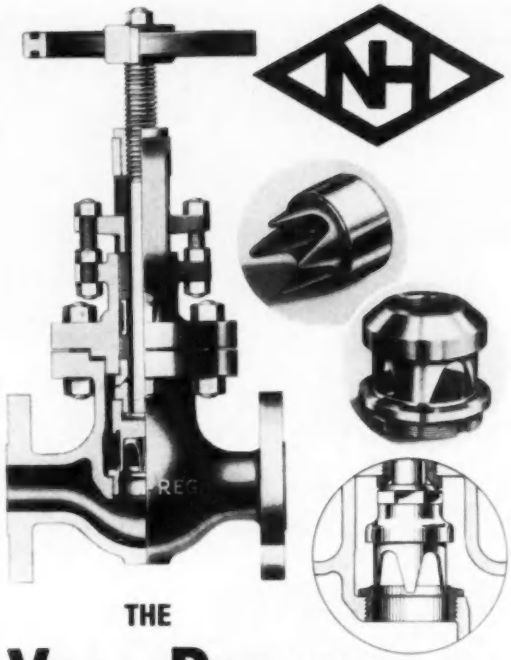
CO_2 INDICATOR

SHANDON

SHANDON SCIENTIFIC COMPANY LTD.

6 Cromwell Place, London, S.W.7

KNightsbridge 1131



THE

Vee-Reg

Regulating Stop Valve

Showing how seating faces are protected and fine graduated control obtained.

The circular diagram shows the patented principle which makes the valve capable of very fine graduated control. Its simplicity is the guarantee of its reliability in the steam and fluid services for which it was developed.

Fullest details gladly sent on request.

NEWMAN, HENDER & Co., Ltd.

WOODCHESTER, Stroud, Glos.

Telephone: Nailsworth 360. Telex 4375.

Principal Stockists and Service Agents

THE BRITISH STEAM SPECIALTIES LIMITED

LEICESTER and BRANCHES

LAIDLAW DREW's

LATEST CONTRIBUTION TO OIL FIRING

Specially designed for Tubular Flue Boilers

A.A.P.

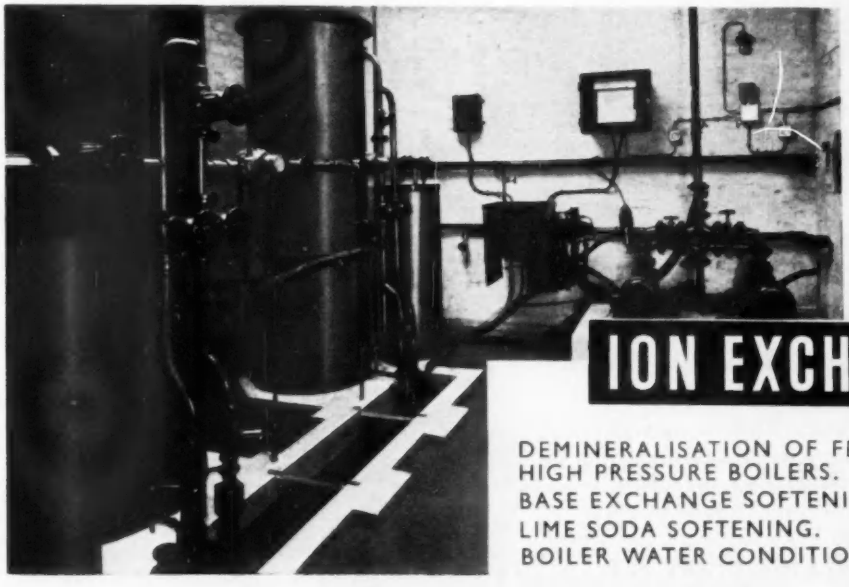
(AIR ASSISTED PRESSURE JET EQUIPMENT)

DUAL ATOMISATION-TWO STAGE COMBUSTION

Full details from :-

LAIDLAW, DREW & CO. LTD.,
Sighthill Industrial Estate,
EDINBURGH, 11
Telephone : CRAiglockhart 4422
Telegrams : "ERICLEX, EDINBURGH"

LONDON OFFICE :
63 Queen Victoria Street, E.C.4.
Tel : CITY 1155/6



UEL

ION EXCHANGE

DEMINERALISATION OF FEED WATER FOR HIGH PRESSURE BOILERS.
BASE EXCHANGE SOFTENING.
LIME SODA SOFTENING.
BOILER WATER CONDITIONING.

UNITED FILTERS & ENGINEERING LTD
WATER TREATMENT SPECIALISTS—LONDON, S.W.15

UNIFILTER HOUSE
BURSTON RD., S.W.15
Tel: PUTney 4441

save oil
save coal
save gas

save explosions too!

it costs less with
AERCON
DRAUGHT BALANCES

Write now for descriptive literature of

AERCON **DRAUGHT BALANCES**

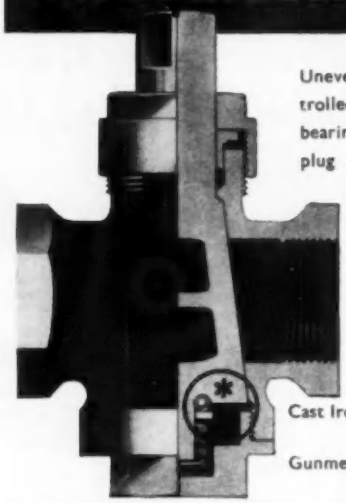
A great many AERCON draught balances have been and are being installed by County Councils, Education Authorities and leading Heating Engineers and Industrial Organisations

also for details of the
AERCON EVACUATION VALVES
for maintaining air at a predetermined pressure

***to* Power Utilities Ltd.**

LOMBARD HOUSE, GREAT CHARLES STREET, BIRMINGHAM, 3 'Phone: Central 3446-7-8-9

THIS COCK DOESN'T JAM



Uneven expansion is controlled by spring-fed ball bearings which keep the plug always free in the barrel. Made in sizes ¼ in. to 6 in. with flanged or screwed ends.

Suitable for steam, gases, liquids or liquors.

Cast Iron for up to 50 lb. p.s.i.

Gunmetal for up to 200 lb. p.s.i.

UNITED STATES METALLIC PACKING CO. LTD.

Soho Works, Bradford 8
Telegrams: "Metallic," Bradford
Telephone 41284-5

U.S.M.P

Branch Offices: London, Liverpool, Glasgow, Manchester, Newcastle, Cardiff, Southampton, Hull, Swansea and Bristol.

LARK **TUBE CLEANING EQUIPMENT**

cuts breakdown costs!

LARK 'GD 250' TUBE CLEANER

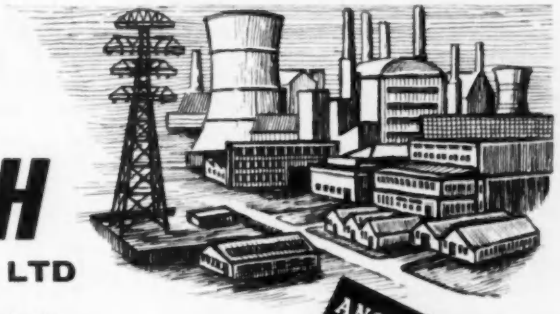
for Condensers and Heat Exchangers

Powerful geared "Lark" air motor speed 2,000 r.p.m. operating pressure 80 lb./sq. in. designed for straight tubes ½" to 2" I.D. Drills, reamers, brushes supplied together with drive and driven shafts of any length. Replaces slow hand cleaning methods.

Please write for further details of Lark tube cleaning equipment.

INDUSTRIAL DESCALING TOOLS LTD
Sole distributors for the manufacturers H. WILLIAMS & SON LTD
LARK WORKS, SANDRIDGE ROAD, ST. ALBANS, HERTS.

ANGLO-SWEDISH



ELECTRIC WELDING CO. LTD

FOR FIRST CLASS WELDING
UNDER THE STRICTEST SUPERVISION

We have ample facilities for handling top-grade welding repairs to boilers, castings, machine parts, etc.—with expert technicians for Fabrication work, Structural Steel work, Tank construction and Electric Stud Welding. Let us send you this descriptive colour brochure.

For immediate service contact us NOW—

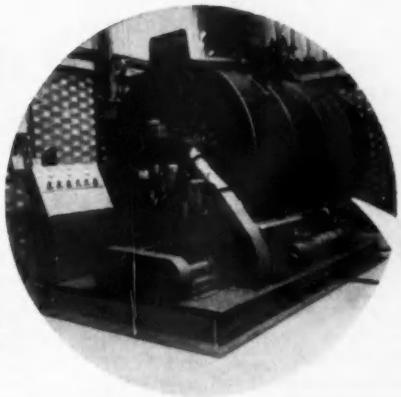
ANGLO-SWEDISH ELECTRIC WELDING CO LTD
WOOD WHARF · GREENWICH · LONDON S E 10
Telephone: GREENWICH 2024-5

FREE COLOUR BROCHURE

NEWCASTLE · LIVERPOOL
GLASGOW · LEITH · LONDON

Accessibility top and bottom

ONE OF THE MANY IMPORTANT FEATURES



SUPAPAK FULLY AUTOMATIC PACKAGE BOILER

DANKS

ALSO AT
MANCHESTER
BIRMINGHAM
NEWCASTLE
SWANSEA

of **NETHERTON LIMITED**
NETHERTON, Nr. DUDLEY, WORCS.
TELEPHONE CRADLEY HEATH 66417
LONDON OFFICE: BANK CHAMBERS, 329 HIGH HOLBORN, W.C.1

TA31

Index to Advertisers

	Page
Airetool Mfg. Co. Ltd.	xlvii
Albright & Wilson Ltd.	xxxv
Alldays & Onions Ltd.	lviii
Allen, W. H., Sons & Co. Ltd.	l
Anglo-Swedish Electric Welding Co. Ltd.	lxvii
Associated Electrical Industries Ltd.	lii
Auld, David, & Sons Ltd.	lx
Babcock & Wilcox Ltd.	liv
Bennis Combustion Ltd.	xlvi
Boby, Wm., & Co. Ltd.	vi
British Ermeto Corporation Ltd.	xxxiv
British Paints Ltd.	lxii
British Rototherm Ltd.	lxii
British Steam Specialties Ltd.	lvi
Caird & Rayner Ltd.	lvii
Carron Company, The	lxiii
Chemical & Insulating Co. Ltd.	lv
Classified Advertisements	lxviii
Clyde Blowers Ltd.	lxx
Cockerill-Ougree	xv
Consolidated Pneumatic Tool Co. Ltd.	xii
Crane Ltd.	xx
Crosthwaite Furnaces & Scriven Machine Tools Ltd	xxi
Danfoss Manufacturing Co. Ltd.	Cover i
Danks, Edwin	363
Danks of Netherton Ltd.	lxvii
Davey, Paxman & Co. Ltd.	xlviii
Dewrance & Co. Ltd.	xix
Dick's Asbestos Co. Ltd.	xxiii
Dohm Ltd.	xiv
Electronic Switchgear	lxiii
Evershed & Vignoles Ltd.	xxii
Fibreglass Ltd.	xxxii
Firth, Thos., & John Brown Ltd.	xliii
Flexible Shaft Mfg. Co. Ltd.	ii
Fluidrive Eng. Co. Ltd.	xi
Foster Wheeler Ltd.	xxix
G. W. B. Furnaces Ltd.	xlii
Gordon, James, & Co. Ltd.	lxx
Green, E., & Son Ltd.	xvii
Hayward Tyler Ltd.	xli
Hopkinsons Ltd.	xxvii
Imperial Chemical Industries Ltd.	xxiv
Industrial Descaling Tools Ltd.	lxvi
Kay & Co. Ltd.	iv
Keith Blackman Ltd.	xviii, Back Cover
Kelvin & Hughes Ltd.	xxxvi
Kleen-E-Ze Brush Co. Ltd.	lxii
Lafarge Aluminous Cement Co. Ltd.	lxix
Laidlaw Drew & Co. Ltd.	lxv
Leeds Meter Co. Ltd.	lxi
Lucas, Joseph, (Hydraulic & Combustion Equipment) Ltd.	v
Mathwin, Wm., & Son (Newcastle) Ltd.	lx
Matthews & Yates Ltd.	xxxiii
National Coal Board	xxx, xxxi
National Industrial Fuel Efficiency Service	lvii
Negretti & Zambra Ltd.	x
Newman Hender & Co. Ltd.	lxiv
Niagara Eng. Co. Ltd.	lvi
Oil Burner Components Ltd.	lxviii
Permutit Co. Ltd.	iii
Power Utilities Ltd.	lxvi
Proctor, James, Ltd.	vii
Reavell & Co. Ltd.	ix
Richardsons Westgarth Ltd.	xxvi
Riley (I.C.) Products Ltd.	xlix
Shandon Scientific Co. Ltd.	lxiv
Simon-Carves Ltd.	xxxvii
Simplifix Couplings Ltd.	xxv
Sound Controls Ltd.	xl
Spanner Boilers Ltd.	xxxviii
Spirax-Sarco Ltd.	xiii
Starit Ltd.	xxviii
Stockton Chemical Engineers & Riley Boilers Ltd.	viii
Superheater Co. Ltd., The	lxxi
Thompson, J., Ltd.	xxxix
Turbine Furnace Co. Ltd.	lx
United Filters & Eng. Ltd.	lxv
United States Metallic Packing Co. Ltd.	lxvi
Versil Ltd.	xliv, xlv
Vokes Genspring Ltd.	lxi
Weir, G. & J., Ltd.	li
Whiffen & Sons Ltd.	xvi
Wicksteed, Chas., & Co. Ltd.	lviii
Willcox, W. H., & Co. Ltd.	lix

CLASSIFIED ADVERTISEMENTS

6d. per word (minimum charge 10s. 6d.). Use of Box No. 2s. 6d. extra

LONDON COUNTY COUNCIL

Paddington Technical College: TWO ASSISTANTS, Grade B, to teach heating and ventilating theory and practice, to apprentices of the heating and ventilating industry. O.N.C. or similar qualification with good industrial experience.

Burnham F.E. salary scale £700 x £27 10s.-£1,150 plus London allowance and possible additions for qualifications and training; increments within scale for experience.

Application forms from Secretary at College, Saltram Crescent, W.9, returnable within 14 days of advertisement date (2235).

DESIGN AND DEVELOPMENT ENGINEER

Opportunity for a design and development engineer to fill a permanent position in the London Office of a progressive and well established engineering company.

The man who will fill this position will be up to degree standard, or equivalent, and will be reasonably experienced on heat transfer and fluid flow. A background of power plant engineering and some knowledge of steel-works practice would be an advantage.

Applicants should give details of education, qualifications and experience and state age and salary expected.

Reply to Box No. 273, ENGINEERING AND BOILER HOUSE REVIEW, 19-20, Noel Street, London, W.1.

It's as simple as OBC

ALL THESE PARTS FROM ALL THESE PLACES

DROITWICH
LONDON
GLASGOW
NEWCASTLE on TYNE
MANCHESTER
BOURNEMOUTH
CARDIFF
DUBLIN
BRISTOL
BELFAST

Now one order covers *all* the burner parts, controls and heating accessories you need. No more delay, no more to pay. Write now and book your copy of O.B.C's 1960 Catalogue which will list thousands of stock items.

OIL BURNER COMPONENTS LTD

BOX A 733 DROITWICH, Worcs.

* Use Refractory Concrete for **Furnace & Boiler Foundations**

It saves money, labour, time and depth

- Has a high insulation value and affords maximum protection to the underlying structural foundations (9″ thickness has the same insulating value as 12″ of firebrick).
- Means monolithic construction and therefore cheap, quick and easy installation.
- Eliminates joints and reduces heat losses to a minimum.
- Is ready for service 24 hours after placing and also has a high cold strength.
- Is non-spalling under wide and sudden changes of temperature and stable under load up to 1300°C.

* REFRACTORY CONCRETE is the adaptable refractory material, made with CIMENT FONDU Aluminous Cement and crushed firebrick.

Please send for further details and photographic examples.

USE SECAR 250
(an iron-free white calcium-aluminate cement)
for
Super Duty and
Special Conditions of:
Higher temperatures up to 1800°C
Reducing atmospheres
Resistance to Slag attack
Resistance to products of combustion
Write for booklet "SECAR 250"

CIMENT FONDU
Regd. Trade Mark
ALUMINOUS CEMENT

The Cement for Industry

FOR SPEED · STRENGTH
RESISTANCE · REFRACTORINESS

Manufactured by

LAFARGE ALUMINOUS CEMENT COMPANY LIMITED

73, BROOK STREET, LONDON, W.1. Telephone: MAYfair 8546

AP 3/1393

When tracking down costly inefficiency in boiler plant it pays to give the job to an expert.

Our many years' experience in how to get the best out of boilers frequently shows how a small outlay for essential instruments and simple automatic control can produce large savings in fuel and make elaborate installations of such equipment unnecessary.

Why not discuss it with one of our engineers ?

GORDON *service*
gets the best out of your boilers

JAMES GORDON & CO. LTD, *DALSTON GARDENS, STANMORE, MIDDX*

A MEMBER OF THE ELLIOTT-AUTOMATION GROUP

CLEAN BOILER TUBES FOR MORE POWER

There is a Clyde Blower applicable to every type of Boiler—Land or Marine

CLYDE *Soot* BLOWERS

for WATER TUBE and MULTI-TUBULAR BOILERS MANUALLY or ELECTRICALLY OPERATED

CLYDE LONG LENGTH *RETRACTABLE* BLOWER

This Blower is used to clean the heating surfaces whose short stroke Single Nozzle Blowers, or other types, are not applicable due to the boiler design. The lance tube is projected, rotated and retracted by individual motors. Automatic push button control is provided by wall mounted starter, or by Cubicle.

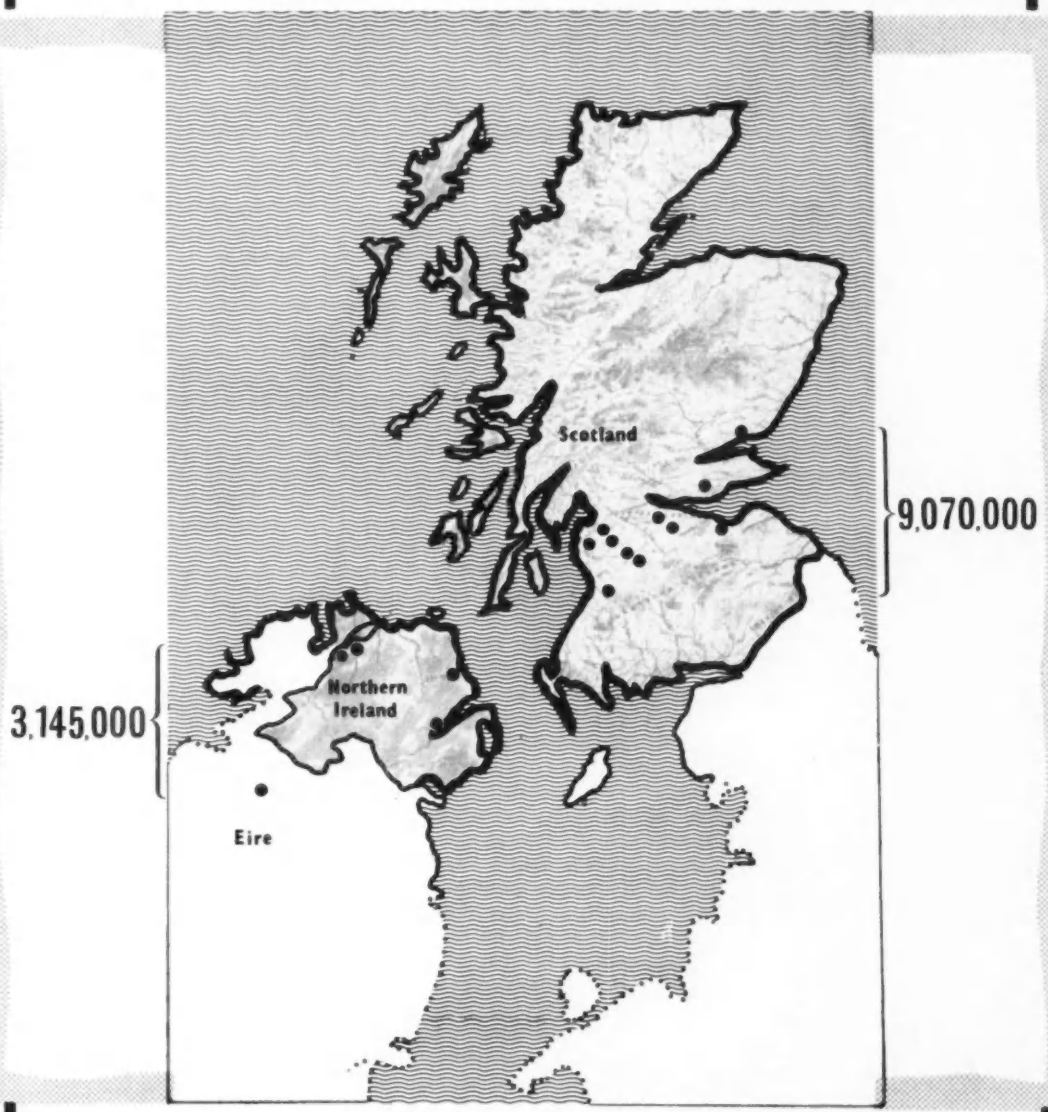
CLYDE BLOWERS LTD

CLYDEBANK · SCOTLAND

Tel. CLY 2161/4 *Telegrams: "MURWILS GLASGOW"*
LONDON: 34, VICTORIA STREET, S.W.1. *Tel. Abbey 1847*
LIVERPOOL: 7 TITHEBARN STREET. *Tel. Central 5071*

12,215,000 lbs/hr

This figure, which is the total evaporative capacity of boilers fitted with Melesco Superheaters for Electrical undertakings in Scotland and Ireland, provides excellent testimony to the 49 years of unique experience in the design, manufacture and operation of superheaters and reheaters for all types of boilers.



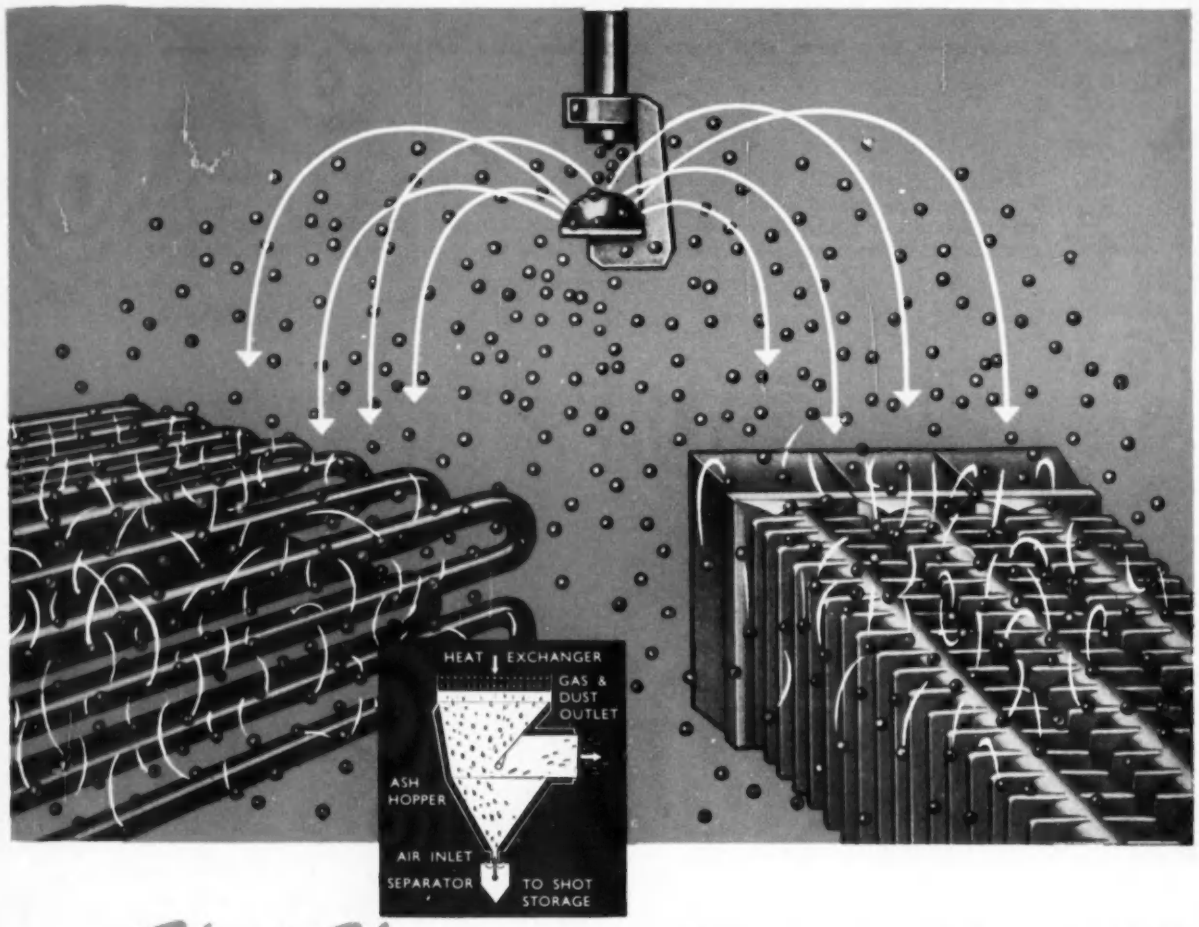
THE SUPERHEATER CO. LTD.

97, TOTTENHAM COURT ROAD, LONDON W.1.

Telephone: LANgham 0431 Telex: 22-408

THE MANCHESTER WORKS

THE AUTHORITY ON SUPERHEATED STEAM



Shot Cleaning maintains constant temperature in heat exchangers at all times

GET MAXIMUM EFFICIENCY from new heat exchangers; recover lost power from old. Install the KEITH BLACKMAN-BROMAN EKSTROM SHOT CLEANING SYSTEM which, irrespective of fuel (coal, oil, waste heat, sulphite, sulphate liquor or creosote pitch), offers many indisputable advantages:

SHOT CLEANING maintains continuously, constant temperature in the boiler, economiser or preheater—by dislodging deposits from heat transfer surfaces *before* thermal efficiency or boiler draught is affected.

SHOT CLEANING acts with the boiler under full load—no shut down, no dampering back. It ensures plant availability all the time—requires no outages for cleaning.

SHOT CLEANING is a dry cleaning method—no steam, no air, no water is introduced to affect the dew point of gases, as in conventional methods.

SHOT CLEANING permits the installation of the right size heat exchanger—no need now for the larger than necessary plant which allows for gradual decline in efficiency.

SHOT CLEANING has proved its effectiveness in POWER STATIONS, GAS WORKS, FOUNDRIES and other INDUSTRIAL PLANTS throughout the world including Europe, U.S.A., Canada, U.S.S.R., Japan and India. Your enquiry benefits from the experience gained from the installation of hundreds of such plants.

IN BRIEF. Shot cascades evenly over the cross-sectional area of the tubes. It ricochets from tube to tube, plain or gilled, dispersing undesirable deposits before they can accumulate. The shot is pneumatically recirculated just as long as is necessary to keep heating surfaces clean—generally about 20 minutes during any 8 hour shift. Simplicity of the system is reflected in the extremely low operating and maintenance costs. Installation costs too are often far less than with conventional cleaning methods.

KEITH BLACKMAN - BROMAN EKSTROM *Shot Cleaning*
PROMOTES MAXIMUM HEAT TRANSFER

Write now for descriptive Publication 35/10

Keith Blackman Ltd MILL MEAD ROAD · LONDON · N.17

Incorporating Blackman Export Co. Ltd.

and at Birmingham · Bristol · Glasgow · Leeds · Leicester · Manchester · Newcastle-on-Tyne

Proprietors and Publishers: Engineering Review Publishing Co. Ltd., Registered Offices, 19-20, Noel Street, London W.1.
Printed by Electrical Press Ltd., at Cordwallis Works, Maidenhead, Berks.
Registered for transmission by Magazine Post to Canada including Newfoundland.